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Report on the individual review of the annual submission of Ukraine submitted in 2017*

Note by the expert review team

Summary

Each Party included in Annex I to the Convention must submit an annual greenhouse gas (GHG) inventory covering emissions and removals of GHG emissions for all years from the base year (or period) to two years before the inventory due date (decision 24/CP.19). Parties included in Annex I to the Convention that are Parties to the Kyoto Protocol are also required to report supplementary information under Article 7, paragraph 1, of the Kyoto Protocol with the inventory submission due under the Convention. This report presents the results of the individual inventory review of the 2017 annual submission of Ukraine, conducted by an expert review team in accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol". The review took place from 4 to 9 September 2017 in Kiev, Ukraine.

* In the symbol for this document, 2017 refers to the year in which the inventory was submitted, not to the year of publication.

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Contents

		Paragraphs	*Page*
	Abbreviations and acronyms		3
I.	Introduction	1–5	5
II.	Summary and general assessment of the 2017 annual submission	6	6
III.	Status of implementation of issues and/or problems raised in the previous review report	7	8
IV.	Issues identified in three successive reviews and not addressed by the Party	8	31
V.	Additional findings made during the 2017 individual inventory review	9	33
VI.	Accounting quantities for activities under Article 3, paragraph 3, and, if any, activities under Article 3, paragraph 4, of the Kyoto Protocol	10	58
VII.	Question of implementation	11	58
Annexes			
I.	Overview of greenhouse gas emissions and removals for Ukraine for submission year 2017 and data and information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, as submitted by Ukraine		59
II.	Information to be included in the compilation and accounting database		63
III.	Additional information to support findings in table 2		65
IV.	Documents and information used during the review		66

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AAU	assigned amount unit
AD	activity data
Annex A sources	source categories included in Annex A to the Kyoto Protocol
AR	afforestation and reforestation
Article 8 review guidelines	"Guidelines for review under Article 8 of the Kyoto Protocol"
CER	certified emission reduction
CETI NASU	Coal Energy Technology Institute of the National Academy of Sciences of Ukraine
CH_4	methane
Cherkasky NIITEKHIM	Cherkasky State Scientific Research Institute of Technical and Economic Information in the Chemical Industry
CLRTAP	Convention on Long-range Transboundary Air Pollution
CM	cropland management
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
COP	Conference of the Parties
CORINE	Coordination of Information on the Environment
CPR	commitment period reserve
CRF	common reporting format
CSC	carbon stock change
DE	digestible energy
dm	dry matter
DOC	degradable organic carbon
DOC_f	fraction of degradable organic carbon that can decompose
DOM	dead organic matter
EF	emission factor
ERT	expert review team
ERU	emission reduction unit
FAO	Food and Agriculture Organization of the United Nations
$F_{IND-COM}$	factor for industrial and commercial co-discharged protein into sewer system
FM	forest management
FMRL	forest management reference level
FMRLcorr	forest management reference level after application of the technical correction
$F_{NON-CON}$	factor for non-consumed protein added to wastewater
$Frac_{GASF}$	fraction of synthetic fertilizer nitrogen that volatilizes as ammonia and nitrogen oxides
$Frac_{GASM}$	fraction of applied organic nitrogen fertilizer materials and of urine and dung nitrogen deposited by grazing animals that volatilizes as ammonia and nitrogen oxides
$Frac_{LEACH}$	fraction of all nitrogen added to/mineralized in managed soils in regions where leaching/run-off occurs that is lost through leaching and run-off
GE	gross energy intake
GHG	greenhouse gas
GM	grazing land management
GWP	global warming potential

HFC	hydrofluorocarbon
HFC-134a	hydrofluorocarbon-134a
HWP	harvested wood products
IE	included elsewhere
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
ITL	international transaction log
KP-LULUCF activities	activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
Kyoto Protocol Supplement	*2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*
LPG	liquefied petroleum gas
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
MENR	Ministry of Ecology and Natural Resources of Ukraine
MMS	manure management system
MSW	municipal solid waste
N	nitrogen
NA	not applicable
NE	not estimated
Nex	nitrogen excretion rate
NF_3	nitrogen trifluoride
NIR	national inventory report
NO	not occurring
NOx	nitrogen oxides
OLU	other land use
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit
RV	revegetation
SEF	standard electronic format
SF_6	sulfur hexafluoride
SIAR	standard independent assessment report
SOC	soil organic carbon
SOC_{REF}	reference soil organic carbon stocks
SOM	soil organic matter
SSSU	State Statistics Service of Ukraine
TAM	typical animal mass
T_{PLANT}	degree of utilization of modern, centralized wastewater treatment plants
UNFCCC Annex I inventory reporting guidelines	"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories"
UNFCCC review guidelines	"Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention"
VS	volatile solids
WDR	wetland drainage and rewetting
Wetlands Supplement	*2013 Supplement to the 2006 Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories: Wetlands*

I. Introduction[1]

1. This report covers the review of the 2017 annual submission of Ukraine organized by the secretariat, in accordance with the Article 8 review guidelines (decision 22/CMP.1, as revised by decision 4/CMP.11). In accordance with the Article 8 review guidelines, this review process also encompasses the review under the Convention as described in the UNFCCC review guidelines, particularly in part III thereof, namely the "UNFCCC guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention" (decision 13/CP.20). The review took place from 4 to 9 September 2017 in Kiev, Ukraine, and was coordinated by Mr. Javier Hanna Figueroa (secretariat). Table 1 provides information on the composition of the ERT that conducted the review of Ukraine.

Table 1
Composition of the expert review team that conducted the review of Ukraine

Area of expertise	*Name*	*Party*
Generalist	Mr. Marius Țăranu	Republic of Moldova
Energy	Mr. Ralph Harthan	Germany
IPPU	Mr. Jacek Skośkiewicz	Poland
Agriculture	Mr. Jonas Bergström	Sweden
LULUCF	Mr. Sandro Federici	San Marino
Waste	Ms. Medea Inashvili	Georgia
National registry	Mr. Günter Pfaff	Austria
Lead reviewers	Mr. Harthan	
	Mr. Țăranu	

2. The basis of the findings in this report is the assessment by the ERT of the consistency of the Party's 2017 annual submission with the Article 8 review guidelines. The ERT has made recommendations that Ukraine resolve the findings related to issues,[2] including issues designated as problems.[3] Other findings, and, if applicable, the encouragements of the ERT to Ukraine to resolve them, are also included.

3. A draft version of this report was communicated to the Government of Ukraine, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

4. Annex I shows annual GHG emissions for Ukraine, including totals excluding and including the LULUCF sector, indirect CO_2 emissions and emissions by gas and by sector. Annex I also contains background data related to emissions and removals from KP-LULUCF activities, if elected, by gas, sector and activity for Ukraine.

5. Information to be included in the compilation and accounting database can be found in annex II.

[1] At the time of publication of this report, Ukraine had not yet submitted its instrument of ratification of the Doha Amendment, and the amendment had not yet entered into force. The implementation of the provisions of the Doha Amendment is therefore considered in this report in the context of decision 1/CMP.8, paragraph 6, pending the entry into force of the amendment.

[2] Issues are defined in decision 13/CP.20, annex, paragraph 81.

[3] Problems are defined in decision 22/CMP.1, annex, paragraphs 68 and 69, as revised by decision 4/CMP.11.

II. Summary and general assessment of the 2017 annual submission

6. Table 2 provides the assessment by the ERT of the annual submission with respect to the tasks undertaken during the review. Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.

Table 2
Summary of review results and general assessment of the inventory of Ukraine

Assessment			*Issue or problem ID#(s) in table 3 and/or 5[a]*
Dates of submission	Original submission: 24 May and 7 September 2017 (NIR and addendum to the NIR, respectively), 24 May 2017, version 1 (CRF tables), 21 July 2017 (SEF-CP1-2015 and SEF-CP1-2016), 31 August 2017 (SEF-CP1-2017) and 6 September 2017 (SEF-CP2-2013, SEF-CP2-2014, SEF-CP2-2015 and SEF-CP2-2016) Revised submission: 20 October 2017, version 2 (CRF tables) Unless otherwise specified, the values from the latest submission are used in this report		
Review format	In-country		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and Wetlands Supplement (if applicable)	1. Have any issues been identified in the following areas:		
	(a) Identification of key categories	No	
	(b) Selection and use of methodologies and assumptions	Yes	A.21, L.2, L.9, L.10, L.32
	(c) Development and selection of EFs	Yes	E.2, A.6, A.8, A.12, A.22, A.24, L.32, W.2, W.13, W.14
	(d) Collection and selection of AD	Yes	A.31, L.7, L.8, L.14, L.19, L.25, L.27, L.30, L.31, L.32, W.2
	(e) Reporting of recalculations	No	
	(f) Reporting of a consistent time series	Yes	I.16, L.10
	(g) Reporting of uncertainties, including methodologies	No	
	(h) QA/QC	QA/QC procedures were assessed in the context of the national system (see para. 2 in this table)	
	(i) Missing categories/completeness[b]	Yes	I.16, L.35, L.36
	(j) Application of corrections to the inventory	No	
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines?	No	W.5, W.6
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	No	E.22, E.23, E.24

Assessment			*Issue or problem ID[a](s) in table 3 and or 5[a]*
Supplementary information under the Kyoto Protocol	2. Have any issues been identified related to the national system:		
	(a) The overall organization of the national system, including the effectiveness and reliability of the institutional, procedural and legal arrangements	Yes	G.8
	(b) Performance of the national system functions	Yes	G.7, G.8, L.27, KL.2, KL.14, KL.15
	3. Have any issues been identified related to the national registry:		
	(a) Overall functioning of the national registry	Yes	G.2
	(b) Performance of the functions of the national registry and the technical standards for data exchange	Yes	G.2
	4. Have any issues been identified related to reporting of information on ERUs, CERs, AAUs and RMUs and on discrepancies reported in accordance with decision 15/CMP.1, annex, chapter I.E, taking into consideration any findings or recommendations contained in the SIAR?	No	
	5. Have any issues been identified in matters related to Article 3, paragraph 14, of the Kyoto Protocol, specifically problems related to the transparency, completeness or timeliness of reporting on the Party's activities related to the priority actions listed in decision 15/CMP.1, annex, paragraph 24, including any changes since the previous annual submission?	Yes	G.9
	6. Have any issues been identified related to the reporting of LULUCF activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, as follows:		
	(a) Reporting requirements in decision 2/CMP.8, annex II, paragraphs 1–5	Yes	KL.1, KL.2, KL.3, KL.13, KL.14, KL.15
	(b) Demonstration of methodological consistency between the reference level and reporting on FM in accordance with decision 2/CMP.7, annex, paragraph 14	Yes	KL.5, KL.6, KL.7
	(c) Reporting requirements of decision 6/CMP.9	No	
	(d) Country-specific information to support provisions for natural disturbances, in accordance with decision 2/CMP.7, annex, paragraphs 33 and 34	NA	
CPR	Was the CPR reported in accordance with the annex to decision 18/CP.7, the annex to decision 11/CMP.1 and decision 1/CMP.8, paragraph 18?	Yes	
Adjustments	Has the ERT applied an adjustment under Article 5, paragraph 2, of the Kyoto Protocol?	No	
	Did the Party submit a revised estimate to replace a previously applied adjustment?	NA	Ukraine does not have a previously applied adjustment

Assessment			*Issue or problem ID[a](s) in table 3 and/or 5[a]*
Response from the Party during the review	Has the Party provided the ERT with responses to the questions raised, including the data and information necessary for the assessment of conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the COP?	Yes	
Recommendation for an exceptional in-country review	On the basis of the issues identified, does the ERT recommend that the next review be conducted as an in-country review?	No	
Question of implementation	Did the ERT list a question of implementation?	No	

[a] The ERT identified additional issues and/or problems in the energy, IPPU, agriculture, LULUCF and waste sectors, as well as issues and/or problems related to reporting on KP-LULUCF activities, that are not listed in this table but are included in table 3 and/or 5.

[b] Missing categories for which methods are provided in the 2006 IPCC Guidelines may affect completeness and are listed in annex III.

III. Status of implementation of issues and/or problems raised in the previous review report

7. Table 3 compiles all the recommendations made in previous review reports that were included in the previous review report, published on 19 April 2017.[4] For each issue and/or problem, the ERT specified whether it believes the issue and/or problem has been resolved by the conclusion of the review of the 2017 annual submission and provided the rationale for its determination, which takes into consideration the publication date of the previous review report and national circumstances.

Table 3
Status of implementation of issues and/or problems raised in the previous review report of Ukraine

ID[a]	*Issue and/or problem classification[b]*	*Recommendation made in previous review report*	*ERT assessment and rationale*
General			
G.1	Commitment period reserve (G.2, 2016) Accuracy	Present the revised value of the CPR in the next NIR using the latest inventory submission as the basis for the calculation of the CPR in accordance with the annex to decision 13/CMP.1, the annex to decision 11/CMP.1 and decision 1/CMP.8, paragraph 18, and take into account the provisions of decision 13/CMP.1, annex, paragraph 8 quinquies.	Resolved. Ukraine reported the revised value of the CPR in the NIR (chapter 12.5, p.319) in accordance with relevant provisions. The reported value was 2,583,419,064 t CO_2 eq.
G.2	National registry (G.3, 2016) Adherence to reporting guidelines under Article 7, paragraph 1, of the	Ensure the proper functioning of the national registry and meet the requirements specified in section II of the annex to decision 13/CMP.1 and the detailed technical requirements for national registries defined in the data exchange	Resolved. The ERT noted that in the national registry of Ukraine, the functionality for enabling transactions and processes for the second commitment period was not yet implemented. During the review, Ukraine indicated that the previous status of full switched-off national registry in the period from 3 August 2015 to 3

[4] FCCC/ARR/2016/UKR.

ID[a]	*Issue and or problem classification*[b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	Kyoto Protocol	standards.	August 2016 (when the registry was reconnected to the ITL in no-operations mode) has been changed on 23 August 2016 to the reconciliation-only mode and that the registry was performing transactions with the ITL in full-operation mode from 23 to 26 June 2017. However, during the review, the ERT noted that as of 9 September 2017 the national registry of Ukraine continued to be in reconciliation-only mode. Taking into account the information provided in the SIAR part I and from responses provided by Ukraine to the questions of the ERT, the ERT concluded that the national registry of Ukraine was not meeting the mandatory requirements for the registry's functionality for the second commitment period. In that context, the ERT noted that the national registry of Ukraine does not fully comply with the functions set out in section II of the annex to decision 13/CMP.1 in conjunction with decision 3/CMP.11. In addition, the ERT also noted that the national registry of Ukraine does not fully comply with decision 1/CMP.8, in particular paragraphs 21, 23, 24 and 26, and the annex to decision 13/CMP.1, paragraphs 16, 21, 33, 34 and 36, in conjunction with decision 3/CMP.11. The ERT included this issue in the list of potential problems and further questions raised by the ERT. The ERT recommended that Ukraine ensure the proper functioning of the national registry, in particular by implementing the additional functionality for the second commitment period that was introduced by decision 3/CMP.11, and also the functionality that was introduced by decision 1/CMP.8. The ERT considered that the proper functioning of the national registry could be achieved by developing and implementing a software functionality or using existing software that includes the second commitment period functionality so that the national registry of Ukraine fully meets the requirements specified in section II of the annex to decision 13/CMP.1 in conjunction with decision 3/CMP.11, other relevant decisions of the CMP, such as decision 1/CMP.8, and the data exchange standards for registry systems under the Kyoto Protocol. In response to the list of potential problems and further questions raised by the ERT, Ukraine informed the ERT that MENR is in the process (situation as at 23 October 2017) of arranging the mentioned upgrade by implementing existing software that includes the second commitment period functionality. Specifically, the "Community Registry Software", which is compatible registry software that is already being used by Parties included in Annex I to the Convention, will be transferred and customized. The activities to be performed include: (1) transfer and customization of the software; (2)

ID[a]	Issue and or problem classification[a]	Recommendation made in previous review report	ERT assessment and rationale
			data migration from the existing first commitment period registry to the upgraded second commitment period registry; and (3) successful completion of the functional test of the registry initialization included in annex H to the technical specifications for data exchange standards for registry systems under the Kyoto Protocol to ensure second commitment period functionality. To complete these activities, international technical assistance to Ukraine has been negotiated and agreed. Under the existing preliminary arrangements, the listed activities are expected to be completed by the end of January 2018. The ERT considered the Party's response and found that Ukraine did not satisfactorily resolve the problem during the review week or within the six-week period after the review week. The ERT noted that the national registry of Ukraine did not meet the mandatory requirements for the registry's functionality for the second commitment period introduced by decision 3/CMP.11 and the functionality that was introduced by decision 1/CMP.8, and that it did not meet the requirements specified in section II of the annex to decision 13/CMP.1 in conjunction with decision 3/CMP.11; other relevant decisions of the CMP, such as decision 1/CMP.8; and the data exchange standards for registry systems under the Kyoto Protocol. In its comments on the draft annual review report of 16 January 2018, Ukraine indicated that the question of proper functionality of the national registry for the second commitment period does not pertain to language of a mandatory nature, at least before the entry into force of the Doha Amendment as set out in decision 1/CMP.8, paragraph 6. Ukraine also indicated that it "…will implement its commitments and other responsibilities in relation to the second commitment period, in a manner consistent with its national legislation or domestic processes". Ukraine noted that it has not deposited its instrument of acceptance of the Doha Amendment nor provided notification of any provisional application of the Doha Amendment to the Depositary. In addition, Ukraine noted that the Doha Amendment had not entered into force as at 16 January 2018. Therefore, Ukraine, in accordance with decision 1/CMP.8, paragraph 6, implements its responsibilities in relation to the second commitment period in a manner consistent with its mandatory national legislation, including budget and public procurement legislation that does not allow it to conduct public procurement .vith the purpose of implementing provisions of international agreements that do not

ID[a]	Issue and/or problem classification[b]	Recommendation made in previous review report	ERT assessment and rationale
			yet have legal force at the national level. Ukraine further indicated that it is currently performing the activities aimed at ensuring the proper functioning of the national registry for the second commitment period on a voluntary basis. On 27 February 2018, Ukraine informed the ERT that the planned establishment of the connection of the national registry with the ITL and completion of the annex H test expected for the end of February 2018 faced some technical issues causing delays in the ambitious preliminary project time frame proposed in November 2017. As at 27 February 2018, the deployment of the new national registry and production platform were to be implemented and work was ongoing on options to ensure the correct and secure process of data migration between the old and the new Ukrainian national registries. According to Ukraine's preliminary assumptions, the activities related to establishing the connection of the national registry with the ITL and completing the annex H test would require one to two months. On 5 March 2018, given the particular situation of Ukraine and the information provided on the progress made in implementing the second commitment period functionality in the national registry of Ukraine, the ERT decided to wait until 4 April 2018 for the possibility that Ukraine could reconnect its national registry to the ITL and pass the annex H test and receive written evidence in this regard. Also, the ERT requested Ukraine to submit, as soon as they are available, results of the connectivity test with the ITL and information about the agreed schedule with the ITL for annex H testing. Taking into account the progress made by Ukraine up to 4 April 2018 based on the assessment of the periodic reports the Party has provided to the ERT since the beginning of March 2018 and the confirmed existing coordination with the ITL, the ERT further decided to postpone the deadline for assessing the proper functioning of the national registry and the implementation of the requirements for the second commitment period functionality until 30 April 2018. On 16 April 2018, Ukraine successfully established a connection from its national registry to the ITL and on 17 April started the annex H test, which was successfully concluded on 24 April 2018. The ERT received the annex H test results for the national registry of Ukraine on 2 May 2018, and received confirmation from the ITL that the national registry of Ukraine is connected to the ITL on 14 May 2018. Therefore, the ERT considers that the national registry of Ukraine meets the mandatory requirements for

ID[a]	Issue and or problem classification[a]	Recommendation made in previous review report	ERT assessment and rationale
			the functionality of national registries for the second commitment period introduced by decisions 1/CMP.8 and 3/CMP.11, and meets the requirements specified in section II of the annex to decision 13/CMP.1 in conjunction with decision 3/CMP.11 and decision 1/CMP.8, and the data exchange standards for registry systems under the Kyoto Protocol. The ERT also considers that the potential problem has been satisfactorily resolved.
G.3	National registry (G.4, 2016) Adherence to reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol	Update the information on the national registry website (carbonunitsregistry.gov.ua) and ensure that the publicly available information is up to date (i.e. updated as close to real time as possible, but updated on a monthly basis at a minimum).	Resolved. All information on the national registry website was updated on 7 September 2017, including the publicly available information. Ukraine also intends to update further all information as close to real time as possible.
G.4	National registry (G.4, 2016) Adherence to reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol	Include up-to-date account information, project information under Article 6 of the Kyoto Protocol, holding and transaction information, and a list of legal entities authorized by the Party.	Resolved. Information on projects under Article 6 of the Kyoto Protocol, holding and transaction information, and a list of legal entities authorized by the Party were updated on the website of the national registry, and information on accounts was enhanced and is now compliant with requirements in the annex to decision 13/CMP.1, paragraph 45, in conjunction with decision 3/CMP.11.
G.5	Kyoto Protocol units (G.5, 2016) Adherence to reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol	Report information on Kyoto Protocol units in accordance with decision 15/CMP.1 and decision 3/CMP.11.	Resolved. The SEF tables for the second commitment period for the years 2013, 2014, 2015 and 2016 were formally submitted by Ukraine on 6 September 2017 during the review week. An addendum to chapters 12 and 14 of the NIR of the 2017 annual submission of Ukraine with additional information on its accounting of Kyoto Protocol units was submitted on 7 September 2017.
G.6	Kyoto Protocol units (G.6, 2016) Adherence to reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol	Prepare and submit a disaster recovery plan and the other information collected annually on the registry transactions and security.	Resolved. During the review, Ukraine provided a disaster recovery plan to the ERT (as confidential information) and formally submitted the plan on 7 September 2017, together with the addendum to chapter 14 of the NIR of the 2017 annual submission.
Energy			
E.1	1. General (energy sector) – all fuels – CO_2, CH_4 and N_2O (E.24, 2016) Transparency	Summarize and report in the NIR, to the extent possible, the details of the methodologies used to estimate the AD and emissions across the territory of the Party to ensure the transparency of the emission estimates.	Resolved. The methodology for adapting AD to ensure completeness with regard to geographical coverage is explained in section A2.15 of annex 2 to the NIR. The methodology is based on, inter alia, a confidential study and open-source information on indicative trends and socioeconomic parameters.
E.2	1.A. Fuel combustion – sectoral approach –	Develop and use country-specific CO_2 EFs for liquid fuels (i.e. residual fuel, diesel oil, LPG, petroleum coke	Addressing. In 2017, a research project was carried out in which national net calorific values and carbon content of gasoline, diesel oil and

ID#	Issue and or problem classification[a]	Recommendation made in previous review report	ERT assessment and rationale
	liquid fuels – CO_2 (E.8, 2016) (E.11, 2015) (31, 2014) Accuracy	and refinery gases) which have a significant share in the fuel mix of stationary combustion.	LPG were developed. The mix of different hydrocarbons, their properties and their proportions in the final fuel were analysed. A comprehensive description, including several tables and graphs, is included in section A2.11.3 of annex 2 to the NIR. However, Ukraine has not yet elaborated in the NIR on the remaining liquid fuel types with a significant share in stationary combustion activities, such as residual fuel oil, petroleum coke and refinery gas. During the review, Ukraine explained that the use of liquid fuels, including refinery gas, for stationary combustion has decreased significantly in recent years. However, on the basis of this information, it remains unclear to the ERT whether emissions from stationary combustion of the outstanding fuels are estimated in line with the guidance provided by the 2006 IPCC Guidelines regarding the selection of tiers (volume 2, section 1.3.1.2).
E.3	1.A. Fuel combustion – sectoral approach – solid fuels – CO_2 and CH_4 (E.9, 2016) (E.25, 2015) Accuracy	Revise the methodology for the quantification of the carbon content of solid fuels, such that it accounts for the fraction of volatile components in the coal itself.	Resolved. In 2017, a research work was published by CETI NASU with results on fuel consumption and coal grades used for each power plant in Ukraine from 1990 to 2015. Values provided include net calorific value, heat proportion of unburned carbon, carbon content and oxidation factor. The ash content is reported in separate annual reports for each power plant. The methodology used in the calculations includes the volatile yield for each different coal grade. A comprehensive description over time and by power plant was included in section A2.11.2 of annex 2 to the NIR and included several tables and graphs.
E.4	1.A.3.b Road transportation – liquid fuels – CO_2 (E.12, 2016) (E.13, 2015) (20 and 35, 2014) (24 and 33, 2013) (53, 2012) (63, 2011) Accuracy	Develop country-specific CO_2 EFs for motor fuels (i.e. gasoline, diesel oil and LPG) based on their carbon content and provide an explanation of the methodology used in the NIR.	Resolved. In 2017, a research project was carried out in which national net calorific values and carbon content of gasoline, diesel oil and LPG were developed (see ID# E.2 above).
E.5	1.A.3.b Road transportation – liquid fuels – CO_2 (E.15, 2016) (E.29, 2015) Accuracy	Apply a higher methodological tier for estimating CO_2 emissions from road transportation.	Resolved. In 2017, a research project was carried out in which national net calorific values and carbon content of gasoline, diesel oil and LPG were developed, which corresponds to a tier 2 approach (see ID# E.2 above).
E.6	1.A.3.b Road transportation – liquid fuels – CO_2, CH_4 and N_2O (E.16, 2016) (E.30, 2015)	Investigate the allocation of emissions from the combustion of lubricants and report the outcome of this assessment.	Addressing. According to a description in section A2.6.1 of annex 2 to the NIR, energy use of lubricants is accounted for under subcategory 1.A.1 energy industries, while the rest is reported under subcategory 1.A.3.b.iv motorcycles. An explanation for this allocation is not provided in the NIR. The ERT noted that, while consumption

ID[a]	Issue and or problem classification[b]	Recommendation made in previous review report	ERT assessment and rationale
	Transparency		in motorcycles may be considered energy related if lubricants are mixed with the fuel (2006 IPCC Guidelines, volume 2, box 3.2.4), other lubricant use needs to be reported in the IPPU sector, according to the 2006 IPCC Guidelines (section 5.2.2). During the review, Ukraine explained that data on lubricant use are provided in the statistics for non-energy use and combustion use, and reported in the IPPU and energy sectors, respectively. Ukraine also explained that lubricants include other heavy oil distillates; for that reason, emissions from lubricants are partially reported in the subcategory energy industries and the rest in the subcategory motorcycles. The ERT also noted that this information is not available in the NIR or CRF tables (e.g. documentation boxes).
E.7	1.A.3.e Other transportation – biomass – CH_4 and N_2O (E.17, 2016) (E.31, 2015) Transparency	Strive to collect data for biodiesel consumption for the period 1990–2012 and report the outcome of those efforts in the NIR and, if impossible, change the notation key for the period 1990–2012 from "NO" to "NE".	Addressing. The ERT noted that biodiesel consumption is reported as "NE" for the years 1990–2012. During the review, Ukraine informed the ERT that no proven information is available for the mentioned years, for which reason the notation key "NE" is reported. Furthermore, in the CRF tables, it is explained that "disaggregate data are not available". However, a corresponding explanation is not included in the NIR. During the review, Ukraine explained that biodiesel consumption was first documented in 2013 in the Autonomous Republic of Crimea as being only 50.4 t and that no information was available regarding whether earlier consumption took place, but, if it did, the amount was very small. After further consultation with the statistical office, Ukraine confirmed that if biodiesel consumption had taken place before 2013, it would be reported under another biomass fuel type ("other types of source fuels"), which is considered as biomass combustion. The ERT noted, however, that since no corresponding explanation is available in the NIR it cannot be confirmed if "NE" is the appropriate notation, since "NO" could be used if it is considered, on the basis of this information, that there was no biodiesel consumption before 2013, or "IE" if the biodiesel consumption is considered to be accounted under another category (elsewhere in the inventory).
E.8	1.A.1 Energy industries – gaseous, liquid and solid fuels – CO_2, CH_4 and N_2O (E.27, 2016) Transparency	Include detailed information on the specific reasons for any conducted recalculations at a disaggregated level in the NIR.	Resolved. The ERT noted that recalculations in the energy industries category were carried out in the 2017 annual submission. A list of reasons and several tables, including the magnitude of recalculations by year and fuel type, are presented in the NIR (chapter 3.2.7.5). Further details on each specific reason are provided in annex 2 to the NIR (sections A2.4, A2.9, A2.10, A2.11.2 and A2.11.3).

ID#	Issue and or problem classification[a]	Recommendation made in previous review report	ERT assessment and rationale
E.9	1.A.1.a Public electricity and heat production – solid fuels – CO_2, CH_4 and N_2O (E.28, 2016) Transparency	Report the country-specific oxidation factors in the NIR, and report further information on how the oxidation factors were established, including the ash sampling protocols followed.	Resolved. In 2017, research work was published by CETI NASU (2017) with results on fuel consumption and coal grades used for each power plant of the country for the years 1990–2015. Supporting documentation on protocols followed and values provided in the work include net calorific value, heat proportion of unburned carbon, carbon content and oxidation factor (see ID# E.3 above).
E.10	1.A.1.a Public electricity and heat production – solid fuels – CO_2, CH_4 and N_2O (E.28, 2016) Transparency	Include supporting information from the research work referenced in the NIR as the source for the typical oxidation factor values used for the subcategories.	Resolved. The choice of oxidation factors is explained in section A2.9 of annex 2 to the NIR (see ID# E.3 above).
E.11	1.A.1.c Manufacture of solid fuels and other energy industries – liquid fuels – CO_2, CH_4 and N_2O (E.29, 2016) Accuracy	Provide a justification for the use of an oxidation factor lower than 1 or use the default oxidation factor of 1 provided in the 2006 IPCC Guidelines.	Resolved. According to section A2.9 of annex 2 to the NIR, oxidation factors were revised in the 2017 annual submission. An oxidation factor of 1 is now used for all stationary combustion categories with the exception of coal combustion in power plants (see ID# E.3 above).
E.12	1.A.2 Manufacturing industries and construction – gaseous, liquid and solid fuels – CO_2, CH_4 and N_2O (E.30, 2016) Comparability	Report coke oven gas under solid fuels (derived gases), and report refinery gases and propylene under liquid fuels (other oil).	Resolved. According to section A2.4 of annex 2 to the NIR, propylene and non-liquefied refinery gas were reallocated to liquid fuels, and coke oven gas to solid fuels. The ERT noted that the IEF for CO_2 emissions from gaseous fuels lies in the range of 55.4 t/TJ to 55.8 t/TJ, well within the range of the 2006 IPCC Guidelines (54.3 t/TJ – 58.3 t/TJ).
E.13	1.A.4 Other sectors – all fuels – CO_2, CH_4 and N_2O (E.31, 2016) Transparency	Include in the NIR detailed information on the recalculations and their impact on the estimates over the time series.	Resolved. The ERT noted that recalculations in the category other sectors were carried out by Ukraine in its 2017 annual submission. A list of reasons for recalculations and several tables, including the magnitude of recalculations by year and fuel type, are presented in chapter 3.2.10.5 of the NIR. Further details on each specific reason for recalculations are provided in the NIR (annex 2, sections A2.4, A2.9, A2.10 and A2.11.3).
E.14	1.B.1.a Coal mining and handling – solid fuels – CO_2 (E.32, 2016) Comparability	Allocate the CO_2 emissions from flaring of coal bed CH_4 under underground mines: mining activities, consistent with the 2006 IPCC Guidelines.	Resolved. According to the NIR (chapter 3.3.1.2.1) and CRF table 1.B.1, CO_2 emissions from flaring of coal bed CH_4 from underground mines are reported under subcategory 1.B.1.a.i mining activities.
E.15	1.B.1.a Coal mining and handling – solid fuels – CO_2 (E.33, 2016) Transparency	Include the information on the methodology used for the estimates of the emissions from flaring of drained CH_4 in the NIR.	Resolved. According to the NIR (chapter 3.3.1.2.1), emissions from flaring of drained CH_4 are estimated on the basis of the default method and default EFs provided in the 2006 IPCC Guidelines.
E.16	1.B.1.a Coal mining and handling – solid fuels – CH_4	Include the following information in the NIR:	Resolved. CH_4 emissions from abandoned coal mines are reported under subcategory 1.B.1.a.1.iii abandoned underground mines. Emissions were

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	(E.19, 2016) (E.32, 2015) Transparency	(a) Management practices in abandoned underground mines; (b) The sampling strategy; (c) The methodology used to extrapolate emissions to the years when measurements are not undertaken.	reported until 2012 on the basis of information from a research institute on labour safety in mining, collected using actual measurements. For the years 2013–2015, a surrogate data reporting method was applied and a description of this approach was included in the NIR (chapter 3.3.1.2.1).
E.17	1.B.2 Oil and natural gas and other emissions from energy production – gaseous and liquid fuels – CO_2 and CH_4 (E.34, 2016) Transparency	Include information on the changes in the EFs, together with justification of the recalculations and of the new EFs used, and information on the impact of the recalculations on the emissions from the category, along with information on the recalculations resulting from other reasons, such as an update of AD.	Resolved. The NIR (chapter 3.3.2.5) describes in detail the recalculations carried out in the category oil and natural gas and other emissions from energy production due to changes in AD, methodology and EFs in different subcategories. Several tables provide changes of AD over time as well as overall resulting changes of emission estimates compared with the 2016 annual submission.
E.18	1.B.2.a Oil – liquid fuels – CO_2 and CH_4 (E.35, 2016) Transparency	Better document and justify the selected CH_4 and CO_2 EFs used for oil exploration and include information on the trend of the CO_2 IEF across the time series or use the default EFs from the 2006 IPCC Guidelines.	Resolved. According to the NIR (chapter 3.3.2.1.2), this category was recalculated using the default CO_2 and CH_4 EFs for oil exploration from the 2006 IPCC Guidelines for all years in the time series.
E.19	1.C.2 Injection and storage – CO_2 (E.36, 2016) Adherence to the UNFCCC Annex I inventory reporting guidelines	For emissions from CO_2 transport and storage, use the notation key "NO" in the CRF tables, in line with decision 24/CP.19, annex I, paragraph 37.	Resolved. In CRF table 1.C, all activities regarding CO_2 transport and storage are reported as "NO".
E.20	Fuel combustion – reference approach – solid fuels – CO_2 (E.25, 2016) Comparability	Review the allocation of coke and coke oven/gas coke under the reference and sectoral approaches with a view to reducing the differences reported for solid fuel consumption and/or provide relevant explanatory information in the NIR.	Resolved. The allocation of individual fuels to overall types of fuels (such as solid) is explained in section A2.4 of annex 2 to the NIR. Reallocation of fuels since the last submission is also explained. Accordingly, coke oven gas was reallocated from gaseous to solid fuels. Coke and gaseous coke remain classified under solid fuels. In 2015, the difference in consumption of solid fuels between the sectoral and the reference approaches was 0.4 per cent.
E.21	Feedstocks, reductants and other non-energy use of fuels – solid and gaseous fuels – CO_2 (E.26, 2016) Consistency	Correct the errors in CRF tables 1.A(b) and 1.A(d) and follow the guidance in section 6.6 of the 2006 IPCC Guidelines to ensure that the carbon excluded reported in CRF table 1.A(b) matches the carbon excluded reported in CRF table 1.A(d), ensuring that for each non-energy use of fuels, information is provided on the fuel quantity, the carbon stored and the estimates and allocation of the relevant emissions.	Resolved. In the 2017 annual submission, the carbon excluded matches the values reported in CRF tables 1.A(b) and 1.A(d) for all solid and gaseous fuels, including coke oven/gas coke. Furthermore, CRF table 1.A(d) provides the allocation of emissions from non-energy fuel use for these fuels.

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IPPU			
I.1	2.A.3 Glass production – CO_2 (I.10, 2016) (I.17, 2015) Transparency	Include a discussion of the development of the EF (0.11 t/t) for glass production in the NIR, including the comparison analysis undertaken with the EF used by other Parties.	Resolved. The CO_2 EF applied ranges between 0.17 t/t and 0.18 t/t, and information on the development of the country-specific EF was included in the NIR (p.124). Ukraine provided additional confidential information to the ERT during the review, justifying the correctness of the applied EF. The ERT noted that a comparison analysis with the EFs used by other Parties was not included in the NIR; however, the revised EF is within the range of EFs reported by other countries (0.03–2.08 t/t), and a comparison analysis is no longer necessary.
I.2	2.B.1 Ammonia production – CO_2 (I.38, 2016) Transparency	Include information in the NIR on the time series of the carbon content of the natural gas used in ammonia production, including information and justification for the assumption used for the years 1990–2003.	Resolved. Information on the carbon content of the natural gas used in ammonia production for 1990–2015 was provided in section A2.11 of annex 2 to the NIR (p.368). The value of carbon content in 2004 was assumed for 1990–2003 when data on the carbon content of natural gas were missing.
I.3	2.B.2 Nitric acid production – N_2O (I.39, 2016) Accuracy	Reconsider the EF used to take into account the use of abatement technologies after 2009 instead of using the same EF across the entire time series and recalculate the N_2O emissions, as necessary.	Resolved. EFs were revised to reflect the use of catalytic destruction of N_2O after 2009 in some of the nitric acid production plants in Ukraine. Corresponding information is provided in the NIR (chapter 4.7.2, p.130).
I.4	2.B.3 Adipic acid production – N_2O (I.21, 2016) (I.28, 2015) Transparency	Report consistently the information on the tier applied to estimate N_2O emissions from adipic acid production and include in the NIR the description of the number and type of abatement systems used in Ukraine and the corresponding destruction and utilization factors.	Addressing. Information on destruction and utilization factors was provided in annex 3 to the NIR (table A3.1.1.9). However, the ERT noted that the NIR has no information on the tier used to estimate N_2O emissions, including a description of the methodology applied. The ERT also noted that a description of the number and type of abatement systems used was not included in the NIR. The only information provided is a reference to the previous annual submission, which lacks transparency to the estimates reported.
I.5	2.B.5 Carbide production – CO_2 (I.40, 2016) Adherence to the UNFCCC Annex I inventory reporting guidelines	Eliminate the inconsistency between the CRF tables and the NIR for CO_2 emissions from carbide production.	Resolved. The mistake was corrected, and consistent information on CO_2 emissions from carbide production was provided in the NIR (chapter 4.10, p.132) and CRF table 2(I).
I.6	2.C.1 Iron and steel production – CO_2 (I.41, 2016) Adherence to the UNFCCC Annex I inventory reporting guidelines	Correct the error in the EFs in the NIR and eliminate the inconsistency between the CRF tables and the NIR for the CO_2 emissions from steel production.	Resolved. The mistake was corrected and consistent information on CO_2 emissions from steel production was provided in the NIR (chapter 4.14.2.2, p.139) and CRF table 2(I).A–H.
I.7	2.C.3 Aluminium production –	Include information on aluminium production in the NIR, covering the	Not resolved. Information on emissions from aluminium production was not provided in the

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	CO_2 and PFCs (I.30, 2016) (I.38, 2015) Transparency	relevant time period, as required by the UNFCCC Annex I inventory reporting guidelines.	NIR. Ukraine indicated that there was no aluminium production for the years 2010–2015, and methodological aspects and uncertainty assessment were given in the 2012 annual submission. However, no information is available in the NIR on methodological aspects and on why there was no aluminium production for the years 2010–2015.
I.8	2.F Product uses as substitutes for ozone-depleting substances – HFCs (I.37, 2016) (I.43, 2015) Transparency	Investigate further disposal emissions, noting that the average lifetime for air-conditioning equipment according to the 2006 IPCC Guidelines is between 10 and 20 years, and document the analysis in the NIR.	Not resolved. Information on disposal emission was not included in the NIR. Analysis of documentation provided during the review describing applied assumptions and justifying a lifetime (15–25 years) that is longer than the default lifetime value of the air-conditioning equipment led the ERT to conclude that emissions from disposal did not occur in 2013–2015 and earlier years (see ID# I.11 and ID# I.15 in table 5).
I.9	2.F.1 Refrigeration and air conditioning – HFCs (I.42, 2016) Completeness	Provide quantitative estimates for emissions from transport refrigeration or include in the NIR the justifying information for the insignificance of the category in accordance with the provisions of decision 24/CP.19, annex I, paragraph 37.	Resolved. Quantitative emission estimates for transport refrigeration are reported in chapter 4.25.1.1.1 of the NIR (p.155) and CRF tables 2(II).B–H (see ID# I.12 and ID# I.13 in table 5).
Agriculture			
A.1	3. General (agriculture) – CO_2, CH_4 and N_2O (A.19, 2016) Adherence to the UNFCCC Annex I inventory reporting guidelines	Improve quality checks in relation to the NIR in order to ensure that the data for the latest inventory year are included in the NIR.	Resolved. The latest inventory year is included in all tables and headings in the agriculture chapter and related annexes of the NIR. However, the ERT noted that improved quality checks are still needed (see ID# A.17 in table 5).
A.2	3.A Enteric fermentation – CH_4 (A.3, 2016) (A.5, 2015) Transparency	Provide an explanation of the standard live weights for various groups of non-dairy cattle and the reasons for the trend between 1990 and 2013 in the NIR.	Resolved. Ukraine explained in the NIR (table in section A8.1 of annex 8, p.566) that the standard live weights are not used as an active parameter in the emission calculations for the various groups of non-dairy cattle. Hence, the trends for the standard live weights are not relevant when they do not affect the estimation of the CH_4 emissions from enteric fermentation.
A.3	3.A.1 Cattle – CH_4 (A.20, 2016) Transparency	Investigate the reason for the fluctuation in fodder consumption as reported by SSSU and provide explanatory information in the NIR to justify the estimates.	Not resolved. The ERT noted that no explanation was provided in the NIR on why there are significant fluctuations in fodder consumption per head between some years of the time series.
A.4	3.A.1 Cattle – CH_4 (A.20, 2016) Accuracy	Provide in the NIR an explanation for the decrease in fodder consumption while, at the same time, the milk production from mature dairy cattle increases.	Resolved. The ERT did not observe this trend in the 2017 annual submission. Both fodder consumption and milk production from mature dairy cattle decreased between 1990 and 1997, and from that point in time, both parameters show an increasing trend.

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A.5	3.A.1 Cattle – CH_4 (A.21, 2016) Accuracy	Describe why the fodder intake for growing non-dairy cattle increased by approximately 50 per cent between 1990 and 2014 without any significant changes in weight gain.	Resolved. The ERT noted that GE is not estimated in relation to weight gain AD. GE is estimated from AD provided by SSSU. Ukraine informed the ERT that weight gain is based on expert judgment, and constant values are used for the different cattle categories for all years. In a perfect model, these two variables should correlate, but it could not be considered as a methodological mistake to base different parameters in a model on different sources.
A.6	3.A.1 Cattle – CH_4 (A.21, 2016) Accuracy	Consider the values and trend of the CH_4 IEF for growing cattle and the assumptions and data affecting it, and make any necessary corrections.	Not resolved. The ERT noted that no explanation was reported in the NIR on why the CH_4 IEF for enteric fermentation for growing cattle in the original 2017 annual submission is the highest of all reporting Parties (for 2015, Ukraine reported 62.20 kg CH_4/head/year, and other Parties ranged from 18.78 kg CH_4/head/year to 55.90 kg CH_4/head/year). The ERT considers that this is directly related to the GE rates used by Ukraine that are also higher than for most of the reporting Parties (for 2015, values ranged from 44.93 MJ/head/day to 159.37 MJ/head/day for other Parties). For example, in 2015, only one Party reported a higher value (159.37 MJ/head/day) than the value reported by Ukraine in its original 2017 annual submission (145.90 MJ/head/day) (see ID# A.18 in table 5).
A.7	3.B Manure management – CH_4 and N_2O (A.6, 2016) (A.8, 2015) Transparency	Include a transparent explanation for all recalculations made in the distribution of MMS.	Resolved. Recalculations made between the 2015 and 2016 annual submissions regarding MMS are no longer relevant. Between the 2016 and 2017 annual submissions, no significant recalculations have been performed in the distribution of MMS. However, the ERT noted that general transparency regarding the distribution of the different MMS in the country is still not sufficient in the NIR (see ID# A.23 in table 5).
A.8	3.B Manure management – CH_4 and N_2O (A.22, 2016) Accuracy	Reconsider the country-specific methodology used for the estimation of the Nex value or apply the methodology suggested in the 2006 IPCC Guidelines (volume 4, chapter 10, equations 10.31 and 10.32) and further justify and thoroughly document in the NIR the Nex values used.	Addressing. Ukraine used a methodology in line with the default methodology described in the 2006 IPCC Guidelines for the estimation of Nex and has updated the NIR with this information (p.199). However, the ERT noted that the Nex values in the revised times series are still high compared with the IPCC default values and higher than the values reported by other Parties (see ID# A.24 in table 5).
A.9	3.B Manure management – N_2O (A.9, 2016) (A.12, 2015) Accuracy	Use the available separate statistics on populations for fox plus raccoon, and mink plus polecat animal groups, apply separate default Nex rates from 2004, apply the average population ratio for fur animals for the period 2004–2013 and apply separate default Nex rates for the period 1990–2003.	Resolved. The Nex values for fur-bearing species between 1990 and 2003 have been revised in the 2017 annual submission. The issue to apply separate Nex values between 2004 and 2013 for the mentioned species was addressed in the 2016 annual submission of Ukraine.
A.10	3.B.1 Cattle – CH_4	Include in the NIR relevant	Addressing. In the 2017 annual submission,

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	(A.23, 2016) Transparency	information on the reported MMS (e.g. how manure is handled, mechanically separated and stored, and the emptying frequencies of the lagoons/manure stores and field application). The description should include a mass balance for all handled manure based on excreted VS in each MMS and if the manure is covered by a crusting layer or not. If the lagoons do not have a crusting layer, use the most appropriate MCF from table 10.17 of the 2006 IPCC Guidelines.	Ukraine provided relevant information, concluding that the previously reported lagoons used for management of manure from cattle actually were emptied at regular intervals and thus that the MCF for liquid MMS (10 per cent) was more appropriate. No description on a mass balance was provided in the NIR. However, the ERT concluded that this information was redundant, considering Ukraine's decision to classify the MMS as liquid instead of a lagoon. The CH_4 emissions for this subcategory were recalculated accordingly in the 2017 annual submission. However, the ERT noted that lagoons as MMS are still reported for swine without providing in the NIR the information requested in the previous review report to confirm that the use of the MCF for lagoons is justified.
A.11	3.B.1 Cattle – CH_4 (A.24, 2016) Accuracy	Continue to make efforts to develop and justify the use of country-specific DE values for the different cattle categories in order to improve the accuracy of the emission estimates for manure management.	Resolved. The ERT noted that country-specific DE values documented and justified by the National Academy of Agrarian Science of Ukraine were used in the 2017 annual submission instead of the default values from the 2006 IPCC Guidelines.
A.12	3.B.3 Swine – CH_4 (A.25, 2016) Accuracy	Investigate in detail the VS excretion rates for swine, revise them as needed and report their values together with the supporting information in the NIR.	Addressing. In the 2017 annual submission, Ukraine provided revised values for VS excretion rates. However, the revised values are higher than the values reported in the previous annual submission. For example, the recalculated value for VS excretion rate in 2014 has increased from 0.47 kg dm/head/day to 0.49 kg dm/head/day. The ERT noted that no relevant information was provided in the NIR to support the high values for VS excretion rates.
A.13	3.D.a Direct N_2O emissions from managed soils – N_2O (A.14, 2016) (A.17, 2015) Transparency	Clarify in the NIR how the area of burning of crop residues on cropland is accounted.	Resolved. According to the NIR (p.219), burning of crop residues is prohibited in Ukraine; hence, no intentional burning of crop residues is occurring. Wildfires affecting crops and crop residues are reported in the LULUCF sector.
A.14	3.D.b.1 Atmospheric deposition – N_2O (A.28, 2016) Transparency	Include in the NIR information on the consumed amounts of different fertilizers (synthetic fertilizers, organic fertilizers, urine, dung and crop residues) and their related ammonia EFs.	Addressing. Information on the ammonia EFs was included in the NIR (chapter 5.5.2.2 and table A3.2.8.8 of annex 3). Consumed amounts of the different fertilizers are reported in the CRF tables.
A.15	3.D.b.1 Atmospheric deposition – N_2O (A.17, 2016) (A.21, 2015) Transparency	Report the coefficients (e.g. $Frac_{GASF}$) used for the estimation of indirect N_2O emissions from soils and the sources for these values.	Resolved. The mentioned coefficients used for the estimation of indirect N_2O emissions from soils (e.g. $Frac_{GASF}$) are reported in the NIR (table A3.2.8.8), and the sources for the values are described in the NIR (chapter 5.5.2.2).
LULUCF			
L.1	4. General (LULUCF) (L.2, 2016) (L.2,	Improve the transparency of the uncertainty analysis in terms of the data sources for each category.	Resolved. Information on data sources for the uncertainty analysis of the sector is reported in the NIR (tables 6.6, 6.9 and 6.12 and chapters

ID[a]	Issue and or problem classification[a]	Recommendation made in previous review report	ERT assessment and rationale
	2015) (65, 2014) Transparency		6.2.3, 6.3.3, 6.4.3, 6.5.3, 6.6.3, 6.7.3 and 6.8.3).
L.2	4. General (LULUCF) – CO_2 (L.3, 2016) (L.4, 2015) (67, 2014) Adherence to the UNFCCC Annex I inventory reporting guidelines	For the model used to calculate the net changes in SOM in mineral soils, verify the model's outputs with measurements annually conducted in the country.	Not resolved. Ukraine did not provide information on verification of the model used to calculate the CSC in mineral soils in the NIR, but reported that additional scientific research is needed to verify the model's outputs (see table in section A8.1 of annex 8). However, the ERT is of the view that verification steps may be implemented within current data availability. The ERT noted that the tier 3 model applied by Ukraine derives SOC changes in cropland remaining cropland and grassland remaining grassland from the N budget. A net accumulation of SOM corresponds to a net accumulation of N proportional to the carbon/nitrogen ratio of SOM, while a net mineralization of SOM corresponds to a net loss of N. The ERT also noted that the input of N from synthetic fertilizers could not be directly correlated with a net SOC accumulation/mineralization. The ERT further noted that verification of model's outputs is relevant, as tier 3 modelling is subject to the provisions of paragraph 41 of the UNFCCC Annex I inventory reporting guidelines. Therefore, the ERT is of the view that verification may be achieved first by applying IPCC methods for estimating N_2O fluxes with the aim to verify the N budget and then by reporting measurements that confirm the correlation between the N budget and the SOC accumulation/mineralization. Consistency between the N budget reported under the LULUCF sector and the one reported under the agriculture sector could also be reported as a means of verification of the model's outputs.
L.3	4. General (LULUCF) – CO_2 (L.4, 2016) (L.5, 2015) (67, 2014) Consistency	Ensure consistency among the different methods used, including the consistency of the soil depth for which the SOC and associated CSCs are calculated, for the different land-use categories, especially for the transfer of land between categories for which different methods are applied.	Resolved. CSCs in the mineral soil pool for all land-conversion categories were revised with the use of the tier 1 method and default EFs with the application of the default 20-year transition period and the default SOC values (i.e. calculated for IPCC default 30 cm depth).
L.4	4. General (LULUCF) – CO_2 (L.5, 2016) (L.6, 2015) (67, 2014) Consistency	Ensure the consistency of the time series of the CSCs in SOM for the entire transition period (i.e. default 20 years) in all land-conversion categories.	Resolved. CSCs in the mineral soil pool for all land-conversion categories were revised for all years of the time series with the use of the tier 1 method and default EFs with the application of the default 20-year transition period.
L.5	4. General (LULUCF) (L.7, 2016) (L.18, 2015) Transparency	Enhance the information reported in the NIR to improve transparency and include, for each estimated category, the verification of outputs (i.e. GHG estimates), if any, noting that the verification of outputs is mandatory for tier 3 estimates.	Addressing. Transparency of information reported has been enhanced by reporting tabular information on the methods and data applied for estimating GHG fluxes such as NIR tables 6.5, 6.8, 6.11, 6.15, 6.17 and 6.19. However, information on the verification of tier 3 estimates has not been provided for all categories (see ID#

ID#	Issue and/or problem classification[a]	Recommendation made in previous review report	ERT assessment and rationale
			L.2 above).
L.6	4. General (LULUCF) – CO_2 and N_2O (L.8, 2016) (L.21, 2015) Accuracy	Use formulation A of the 2006 IPCC Guidelines (volume 4, chapter 4, p.234) for calculating the SOM CSCs in mineral soils, and because the land representation is not spatially explicit, use ancillary data or expert judgment when assigning the soil type to land-use change conversion of mineral soils as currently assumed by Ukraine.	Resolved. The ERT noted that in the land representation reported by Ukraine, land conversions have been estimated (i.e. approach 2 of the 2006 IPCC Guidelines), so formulation A for SOC changes is no longer a requirement for calculating CSCs in mineral soils (see ID# L.9 below).
L.7	Land representation – CO_2, CH_4 and N_2O (L.33, 2016) Accuracy	Collect sufficient data on the land area and changes in the land area, verify the conversions between land-use categories and demonstrate how the accuracy of land representation has improved, clearly documenting the AD used for the sector in the NIR.	Not resolved. The ERT noted that the current land representation reported by Ukraine is based on cadastral data that do not allow the identification of land-conversion categories (i.e. approach 1); from those data, the areas of land-conversion categories are derived by applying assumptions on the basis of expert judgment. However, the ERT also noted that the cadastral data are based on the legal status of land, while the land-conversion identification for the GHG inventory needs information on its actual use (e.g. forest land as per the cadastral area includes areas of forest permanently unstocked that need to be distinguished when area data are used as AD for estimating total forest net increment in biomass carbon stock). Furthermore, area changes reported under the following land-conversion categories from cadastral data have a low and a very low likelihood of actually having occurred: settlements to forest land, other land to forest land, other land to cropland, settlements to grassland, other land to grassland, settlements to wetlands and settlements to other land. The ERT further noted that statistically sound data collection for the entire country area for the time series 1990–2016 of land cover and land-use data may be implemented using freely available data sets of satellite images within a time frame of a few months and with costs limited to the time of the operators who need to collect data by visually interpreting satellite images and to analyse data collected to derive a complete time series of consistent land representation of the entire Ukrainian national territory (see ID# KL.13 and ID# KL.14 in table 5).
L.8	4.A Forest land – CO_2 and N_2O (L.11, 2016) (L.24, 2015) Accuracy	Report all areas that are included under forest land and that are unstocked because of management activities (e.g. firebreaks, forest roads, etc.) under the category managed forest land, possibly under a subdivision such as "unstocked managed forest land", or alternatively according to their dominant use (e.g. firebreaks as grassland and forest roads as	Not resolved. Ukraine did not disaggregate, as a subdivision, permanently unstocked forest land from stocked forest land, although the methodology applied (i.e. increment rate applied across the forest land area) causes an overestimation of CO_2 removals when the increment rate is applied across an area larger than the actual stocked forest land area. Further, the ERT noted that in 2015, 209 kha out of 1,025 kha reported as unmanaged forest land were actually covered by forest (see ID# KL.3 below).

ID[a]	Issue and or problem classification[b]	Recommendation made in previous review report	ERT assessment and rationale
		settlements).	The remaining area reported as unmanaged forest land included permanently unstocked areas or areas with unknown cover. Since 1990, approximately 190 kha of unmanaged forest area, either permanently unstocked or with unknown cover, have been reported as converted to other land use, although such conversion may not imply any biomass carbon stock loss (i.e. conversion of permanently unstocked (unmanaged) forest to other land uses) or may imply an increase of biomass (i.e. conversion of permanently unstocked (unmanaged) forest to managed forest or to woody cropland).
L.9	4.A Forest land – CO_2 (L.14, 2016) (L.27, 2015) Accuracy	Revise the calculations of GHG emissions and removals from forest land in mineral soils following the methods presented in the 2006 IPCC Guidelines and implement sector-specific QC procedures to ensure the accuracy of the estimates reported across the time series.	Not resolved. Although SOC changes in mineral soils from conversions to and from forest land were revised in the 2017 annual submission, the ERT noted that lands have not been stratified by climate zone and soil type as per IPCC good practice for assigning proper SOC_{REF} values to land under conversion. The ERT notes that the establishment of category-specific QC procedures may allow the identification of methodological discrepancies with good practice, as established by the 2006 IPCC Guidelines.
L.10	4.A.1 Forest land remaining forest land – CO_2 (L.15, 2016) (L.8, 2015) (68, 2014) Consistency	Revise the estimates of DOM and establish sector-specific QC procedures to check the time-series consistency of the estimates and their coherence among carbon pools and categories.	Not resolved. Ukraine explained during the review that, since 2013, CSC estimates for the new years did not include any recalculation of the previous time series (i.e. 1990–2010), so the time series are inconsistent. Indeed, the deadwood and litter annual CSCs for the years 2011–2015 are, on average, 60 per cent and 90 per cent, respectively, higher than those reported for 1990–2010. Further, the ERT noted that carbon stocks and CSC factors reported in NIR tables A3.3.10 and A3.3.11 are mutually inconsistent: for instance, the net carbon stock accumulation of litter across 10 years (e.g. by applying the annual accumulation rate reported in the first age class of table A3.3.10) is 2–10 times larger than the average litter carbon stock stored as reported in table A3.3.11. Furthermore, the methodology used (i.e. a net accumulation rate applied across the chronosequence) implies an endless accumulation of DOM carbon stocks in forest land remaining forest land, although, as for biomass, the DOM carbon stocks follow a path of net accumulation at younger ages and subsequent net loss at harvesting, which may result in long-term net accumulation or net loss only if the harvesting cycle is modified (extended or shortened, respectively) or the disturbance regime varies substantially. The ERT notes that the establishment of category-specific QC procedures may allow the identification of failures in completeness, consistency and accuracy of reported and estimates.
L.11	4.A.1 Forest land	Include clear definitions of managed	Addressing. The ERT noted that definitions of

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	remaining forest land – CO_2, CH_4 and N_2O (L.34, 2016) Transparency	and unmanaged forest land and of how unmanaged forest land is detected in the land representation and, if necessary, revise the distribution of forest land between managed and unmanaged.	managed and unmanaged forest land were reported in the NIR (pp.232 and 233). However, the issue of how unmanaged forest land is detected in the land representation and the assignment of areas to managed and unmanaged subdivisions has not been resolved (see ID# L.8 above).
L.12	4.A.1 Forest land remaining forest land – CO_2 (L.35, 2016) Accuracy	Apply a higher tier method to estimate the CSCs in mineral soils for forest land remaining forest land or demonstrate that forest soil is not a significant pool. If this is not possible, explain in the NIR the reasons why it was unable to implement a higher tier method in accordance with the decision tree in the 2006 IPCC Guidelines, consistent with decision 24/CP.19, annex I, paragraph 11.	Resolved. The ERT noted that in the NIR (chapter 6.2.2), Ukraine acknowledged that sufficient data are not available to prepare tier 2 estimates of CSC in mineral soils of forest land remaining forest land. Furthermore, the ERT established that the Ukrainian national system suffers from a lack of resources (see ID# L.27 below and ID# G.8 in table 5), which impedes the timely collection of needed information for preparing accurate GHG estimates. Consequently, the ERT noted that according to the 2006 IPCC Guidelines (volume 1, decision tree 4.1, section 4.1.2), the lack of resources justifies the use of tier 1 estimates for key categories consistently with good practice (see ID# L.33 in table 5). The ERT acknowledged that Ukraine has planned to collect country-specific data to prepare tier 2 estimates, although this is listed with no priority.
L.13	4.A.2 Land converted to forest land – CO_2, CH_4 and N_2O (L.36, 2016) Completeness	Report the CSCs and emissions and removals for all pools for land converted to forest land for the entire time series.	Resolved. Ukraine reported CSCs in the SOM pool for all categories of land converted to forest land for the entire time series, applying the tier 1 method and default EFs. The ERT noted that the notation keys in the CRF tables were revised and correctly used.
L.14	4.B Cropland – CO_2 and N_2O (L.16, 2016) (L.29, 2015) Accuracy	Enhance data collection on the use under which organic soils are reported, and supplement the current data gaps with available ancillary data and expert judgment, where needed, to ensure that no systematic errors affect the estimates of GHG emissions in the time series.	Not resolved. The ERT noted that data collection on the use under which organic soils are reported has not been enhanced and systematic errors affect the estimates of GHG emissions across the time series. The ERT noted that this issue is also relevant to all GHG and all land-use categories (see ID# L.30 in table 5).
L.15	4.B Cropland and 4.C Grassland – CO_2 and N_2O (L.17, 2016) (L.30, 2015) Accuracy	Include justification for the use of the IPCC default values for the warm temperate climate zone for estimating CO_2 emissions from drained organic soils under cropland and grassland.	Resolved. The ERT noted that Ukraine recognized that the IPCC default values for the warm temperate climate zone were not appropriate for estimating CO_2 emissions from drained organic soils under cropland and grassland, and Ukraine has updated them in the 2017 annual submission with those for the cold temperate moist zone.
L.16	4.B.1 Cropland remaining cropland – CO_2 (L.37, 2016) Completeness	Revise the assumption used for estimating the losses from living biomass for cropland remaining cropland and improve the completeness of the inventory by including the missing component "loss" in the CSCs for living biomass.	Resolved. The ERT noted that living biomass losses of woody biomass on cropland remaining cropland were reported in CRF table 4.B. A detailed description of the method and assumptions used for estimating the losses from living biomass is reported in chapter 6.3 and section A3.3.2 of annex 3 to the NIR.

ID[a]	*Issue and or problem classification[b]*	*Recommendation made in previous review report*	*ERT assessment and rationale*
L.17	4.B.2.1 Forest land converted to cropland – CO_2, CH_4 and N_2O (L.38, 2016) Completeness	Estimate and report the CSCs and emissions and removals for all pools for forest land converted to cropland for the entire time series.	Resolved. The ERT noted that complete estimates of emissions and removals for forest land converted to cropland have been reported for all pools for the entire time series.
L.18	4.C.1 Grassland remaining grassland – CO_2, CH_4 and N_2O (L.39, 2016) Transparency	Provide information in the NIR that Ukraine applied a tier 1 method to all pools, other than mineral and organic soils, together with appropriate justification.	Resolved. The ERT noted that transparent information on the methodological tier level applied to each carbon pool is provided in the NIR (table 6.11).
L.19	4.D.1 Wetlands remaining wetlands – CO_2 and N_2O (L.18, 2016) (L.32, 2015) Accuracy	Enhance the data collection on the drainage status of peat production sites once abandoned; supplement the current data gaps with available ancillary data and expert judgment, where needed; and estimate GHG emissions in sites for peat production which, although abandoned, are still under drainage to ensure that no errors affect the GHG emission trend.	Not resolved. The ERT noted that Ukraine reported neither emissions and removals from abandoned peat production sites nor geographical data to allow current land use of such peatlands to be tracked. Further, Ukraine did not apply any ancillary information, including expert judgment, or conduct scientific research to assign formerly drained peatlands to current land use. There is therefore no certainty that abandoned peat production sites are no longer under drainage and that they are not an active source of emissions.
L.20	4.D.2 Land converted to wetlands – CO_2 (L.19, 2016) (L.13, 2015) (75, 2014) Accuracy	Revise the methodology and CSC factors applied for forest land converted to wetlands.	Resolved. The ERT noted that SOC estimates from conversions from forest land to wetlands were revised by applying the tier 1 method. Nevertheless, the ERT also noted that DOM CSC were not revised in the 2017 annual submission (see ID# L.10 above).
L.21	4.D.2 Land converted to wetlands – CO_2 and N_2O (L.20, 2016) (L.33, 2015) Completeness	Identify the areas of land converted to flooded land, especially forest land converted to flooded land, and apply the default IPCC methodology (volume 4, section 7.3.2.1 of the 2006 IPCC Guidelines) or any other method considered more appropriate for the Ukrainian national circumstances.	Resolved. During the review, the ERT was provided with documented information showing that no new water reservoirs have been constructed on forest land since 1990 in Ukraine. Ukraine informed the ERT that this information will be included in its next annual submission.
L.22	4.D.2.3 Land converted to wetlands – CO_2, CH_4 and N_2O (L.41, 2016) Completeness	Estimate and report the CSCs for all pools and the emissions occurring from the conversion of forest land to wetlands for 2014, applying the methods from the 2006 IPCC Guidelines or other approaches deemed appropriate to the national circumstances of Ukraine.	Resolved. Estimates of CSCs have been reported by applying the tier 1 method and default EFs for all relevant pools for all years of the time series, with the exception of 1994, 2011 and 2015 for which "NO" and "NA" have been reported.
L.23	4.E.2 Land converted to settlements and 4.F.2 Land converted to other land – CO_2 and N_2O (L.21, 2016) (L.34, 2015) Completeness	Report the CSCs for land converted to settlements (4.E.2) and land converted to other land (4.F.2) by applying the default IPCC method and factors or any method and factors considered by Ukraine to be more appropriate to its national circumstances, while ensuring that they are in line with good practice.	Resolved. The ERT noted that CSCs from land conversions to settlements and other land were revised by applying the tier 1 method and default EFs from the 2006 IPCC Guidelines.

ID#	Issue and/or problem classification	Recommendation made in previous review report	ERT assessment and rationale
L.24	4.E.2 Land converted to settlements – CO_2, CH_4 and N_2O (L.40, 2015) Completeness	Estimate and report the CSCs and emissions and removals for forest land converted to settlements for all years where these conversions occur and improve the use of the notation keys, in particular using the notation key "NE" instead of "NO" for land conversions occurring in Ukraine when an IPCC methodology is not available.	Resolved. Ukraine estimated and reported the CSCs and the emissions and removals for forest land converted to settlements for the entire time series applying the tier 1 method and default EFs. The ERT noted that the notation keys in the CRF tables were revised and correctly used.
L.25	4.F Other land – CO_2 (L.22, 2015) (L.36, 2015) Comparability	Revise the classification of category 66 ("dry open lands with special vegetation cover"), noting that category 66 appears to more closely match the definition of the IPCC category grassland than other land.	Not resolved. The ERT noted that Ukraine continued to report land category 66 under other land. The ERT also noted that classifying lands with significant carbon stocks (i.e. land category 66) under the category other land, which includes land without significant carbon stocks, creates artefact carbon stock gains, in the case of conversion to forest land, and artefact carbon stock losses, in the case of conversion from forest land, that do not actually occur.
L.26	4.F Other land – CO_2 and N_2O (L.23, 2015) (L.37, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Strengthen the QC procedures for the LULUCF sector (correct the 1990 value for the SOM CSC factor for mineral soils) and report on the improvements implemented.	Addressing. The ERT noted that QC procedures have been strengthened to the extent possible and, for example, the 1990 value for the SOM CSC factor for mineral soils was revised by using the tier 1 method and default EFs. The ERT also noted that Ukraine is in the process of revising all its calculation worksheets and the background data used for estimating CSCs from all carbon pools under all land-use categories.
L.27	4.F.2.1 Forest land converted to other land uses – CO_2 and N_2O (L.24, 2016) (L.38, 2015) Transparency	Subdivide and report separately deforested areas between those that did contain trees and those that did not contain trees before deforestation; report in the NIR a table where, for each carbon pool, the standing carbon stocks before deforestation and after deforestation are reported for those lands that did contain trees before deforestation.	Not resolved. Ukraine reported in the NIR (the table in section A8.1 of annex 8) that this issue cannot be addressed because of a shortage of financial resources. The ERT noted that this issue contains a number of aspects that are considered together with the issue on land representation (see ID# L.7 above), the issue on availability of data on forest CSCs (see ID# KL.13 in table 5) and the general issue on the capacity of the national system to collect needed information and to ensure a timely flow of information from responsible entities to the national GHG inventory unit (see ID# G.8 and ID# KL.14 in table 5).
L.28	4(III) Direct N_2O emissions from N mineralization/ immobilization – N_2O (L.25, 2016) (L.39, 2015) Consistency	Revise the calculations of direct N_2O emissions from N mineralization/immobilization and implement sector-specific QC procedures to ensure the consistency of the emission estimates across the time series.	Resolved. Direct N_2O emissions from N mineralization were revised by applying the tier 1 method and default EFs from the 2006 IPCC Guidelines. The reported time series was consistent suggesting QC procedures were implemented.
L.29	4(III) Direct N_2O emissions from N mineralization/ immobilization – N_2O	Revise the calculations of N_2O emissions from mineralization of SOM, ensuring that such emissions are only estimated and reported in land categories where a net SOC loss	Resolved. Direct N_2O emissions from N mineralization of SOM were revised by excluding land where SOC has increased (see ID# L.28 above).

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	(L.26, 2016) (L.40, 2015) Accuracy	occurs.	
Waste			
W.1	5.A Solid waste disposal on land – CH_4 (W.6, 2016) (W.9, 2015) Accuracy	Examine the accuracy of the population data used for reporting emissions from solid waste disposal on land to ensure that the population data best reflect the population of Ukraine in the respective inventory years and present the results of this analysis in the NIR.	Resolved. Ukraine has accurately reported in the NIR (pp.531–534) the population using the centralized data-collecting system for waste and the estimated share of the population using illegal landfilling. The ERT noted that the population data cover the whole country area and the information is reported in the NIR.
W.2	5.A Solid waste disposal on land – CH_4 (W.10, 2016) Accuracy	Continue to further investigate MSW, taking into consideration the fact that the sampling should be conducted in several typical cities in each season and that the methods, frequency of sampling and implications for the time series should be documented with a view to developing a country-specific EF for the category.	Not resolved. In the NIR, Ukraine is still referring to the MSW composition study conducted from 2008 to 2013 for 22 cities in Ukraine and published in 2014. The ERT noted that there is not sufficient scientific rigour in the study on MSW composition owing to a lack of representativeness, frequency of measurements and accounting of seasonality. In addition, the NIR reported that, in 2012, field and laboratory experiments on DOC determination in food waste were carried out; however, results showed DOC values for food waste were much lower than the 2006 IPCC Guidelines default value. Therefore, taking into account the singularity and non-systematic character of this research, Ukraine considered that additional activities are needed to develop country-specific values.
W.3	5.A Solid waste disposal on land – CH_4 (W.12, 2016) Adherence to the UNFCCC Annex I inventory reporting guidelines	Strengthen QA/QC checks for the waste sector and ensure that the DOC_f value is corrected in the CRF tables and consistently reported between the NIR and the CRF tables.	Not resolved. The DOC_f default value reported in the NIR (p.259) is equal to 0.5 per cent, while in CRF table 5.A the respective value continues to be reported as equal to 13.73 per cent for anaerobic managed waste disposal sites and for unmanaged waste disposal sites.
W.4	5.B. Biological treatment of solid waste – CH_4 and N_2O (W.7, 2016) (W.10, 2015) Consistency	Further investigate the AD for composting and, if the data quality is not sufficient, apply interpolation for 2012 using data for 2011 and 2013.	Resolved. Ukraine recalculated CH_4 and N_2O emissions from composting for 2012 through interpolation using data for 2011 and 2013, ensuring a consistent time series.
W.5	5.C.2 Open burning of waste – CO_2, CH_4 and N_2O (W.11, 2016) Transparency	Include in the NIR information on the waste management practices in rural areas, together with the justification that emissions from open burning are insignificant, in accordance with decision 24/CP.19, annex I, paragraph 37(b).	Addressing. Ukraine has reported all emissions from open burning of waste using the notation keys "NE" and "NA", stating in the NIR that respective emissions are insignificant without providing any evidence in accordance with decision 24/CP.19, annex I, paragraph 37(b). In addition, the NIR did not include explicit information on the waste management practices in rural areas, but it referred to a formal request for information to regional authorities and advice from lead experts, who indicated that the

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			theoretical occurrence of open burning of waste in rural areas is very low. During the review, Ukraine explained that a survey was conducted in the regions where such practices exist and, on the basis of the obtained results, the insignificance of the total direct GHG emissions for this category has been demonstrated. In addition, during the review, the calculation spreadsheet demonstrating the insignificance of these emissions was provided to the ERT as the evidence (see ID# W.6 below).
W.6.	5.C.2 Open burning of waste – CO_2, CH_4 and N_2O (W.13, 2016) Transparency	Further investigate the issue of inconsistency in the reporting of emissions from open burning of waste and quantify the CO_2, CH_4 and N_2O emissions from open burning if considered to be significant.	Addressing. Ukraine has conducted a survey on the practices of open burning of waste in the country. On the basis of the results obtained, CO_2, CH_4 and N_2O emissions were calculated from the open burning of waste in two regions of the country where such practices exist. Taking into account these estimates, the ERT noted that emissions for this category are indeed insignificant (40.27 kt CO_2 eq from both regions, comprising 0.01 per cent of the national total emissions) and thus may be reported as "NE" in the CRF tables; however, justification that emissions from open burning of waste are insignificant must be provided in the NIR, in accordance with decision 24/CP.19, annex I, paragraph 37(b).
KP-LULUCF			
KL.1	Afforestation and reforestation – CO_2 and N_2O (KL.2, 2016) (90, 2014) Transparency	Report in the NIR additional information on the model applied to estimate the SOM CSCs in land converted to forest land, as well as a table where the areas converted to forest land and the CSCs in each carbon pool are reported, stratified by land-use conversion type, climatic zone and year of conversion.	Not resolved. The ERT noted that Ukraine has expressed during the review the intention to apply a tier 1 method and default factors in its next annual submission to estimate the SOM CSCs in land converted to forest land. The ERT recalled that lands have to be stratified by climate zone and soil type in line with good practice for assigning proper SOC_{REF} values.
KL.2	Deforestation – CO_2 and N_2O (KL.3, 2016) (94, 2014) Completeness	Report in the NIR additional information on how the CSC factors applied to estimate the CSCs in forest land converted to other land use are calculated, as well as a table where the areas converted to forest land and the CSCs in each carbon pool are reported, stratified by land-use conversion type, climatic zone and year of conversion.	Not resolved. The ERT noted that Ukraine clarified during the review that biomass carbon stock losses were quantified according to information collected in deforested areas by the State Forest Resource Agency. However, this agency collects data on about two thirds of the national forest area. Related issues regarding SOM and DOM CSCs are discussed in detail, respectively, in ID# L.9 and ID# L.10 above. Related issues regarding the capacity of the national system to collect enough data for preparing the national GHG inventory, in particular for areas of forest land converted to other land and areas of land converted to forest land, are discussed in detail in ID# G.8 in table 5.
KL.3	Forest management – CO_2, CH_4 and N_2O (KL.4, 2016)	Report information on how unmanaged forest land is defined and identified and document, if unmanaged forest land is subject to	Not resolved. The ERT noted that Ukraine has reported in the NIR the definitions of forest under management and unmanaged forest and that unmanaged forest land includes forest in the

ID[a]	Issue and/or problem classification[a]	Recommendation made in previous review report	ERT assessment and rationale
	Accuracy	the impact of any human activity, how any possible unbalanced accounting is avoided.	exclusion area of Chernobyl (150.00 kha) and an integral reserve in the Carpathian Mountains (59.00 kha), and for the remaining area, no information on their location and on their actual status is provided, although during the review Ukraine clarified that unmanaged forest land also includes permanently unstocked areas that may be subject to human activities. The ERT also noted a discrepancy between the area of managed forest reported under the Convention (managed forest land remaining forest land and land converted to forest land, i.e. 9,650.813 kha in 2013, 9,635.805 kha in 2014 and 9,608.571 kha in 2015) and the Kyoto Protocol (forest under FM and afforested land, i.e. 9,651.043 kha in 2013, 9,656.243 kha in 2014 and 9,661.457 kha in 2015). These discrepancies indicate that some forest areas reported as unmanaged under the Convention are inconsistently reported under management activities under the Kyoto Protocol; such inconsistency remains to be addressed.
KL.4	Forest management – CO_2, CH_4 and N_2O (KL.5, 2016) Transparency	Report as a technical correction in CRF table 4(KP-I)B.1.1 and in the CRF accounting table the value resulting from the subtraction of the FMRL value inscribed in decision 2/CMP.7 from the recalculated FMRLcorr value.	Resolved. The correct value of the technical correction has been reported in CRF table 4(KP-I)B.1.1 and in the CRF accounting table (−13,435 kt CO_2 eq/year).
KL.5	Forest management – CO_2, CH_4 and N_2O (KL.6, 2016) Transparency	Report complete and clear information to ensure the transparency of each technical correction to its FMRL on: (1) the rationale for calculating the FMRLcorr value; (2) the methods used to calculate the FMRLcorr value (including all background data and parameters used); (3) the results (i.e. the FMRLcorr and the technical correction value) and a discussion of the differences between the FMRLcorr and the FMRL values (i.e. the causes and, where possible, the percentage impact for each cause); in particular, for this purpose, it is good practice to report a comparison of the recalculated estimates with the previous estimates (see table 2.7.2 of the Kyoto Protocol Supplement); and (4) complete information that demonstrates consistency between the FMRLcorr value and the FM GHG estimates.	Not resolved. No information has been reported in the NIR on (1), (2) and (4), while for (3) no information has been reported on the reasons/causes of differences between FMRLcorr and FMRL values.
KL.6	Forest management – CO_2 (KL.7, 2016) Accuracy	Either calculate the biomass carbon stock gains in forest land, applying the forest age-class structure and age-class dependent increment rates, or take this inconsistency into	Not resolved. During the review, Ukraine informed the ERT that it will calculate and report in its next annual submission the technical correction of the FMRL by projecting it, applying data and methods included in recommendations

ID#	Issue and or problem classification[a]	Recommendation made in previous review report	ERT assessment and rationale
		consideration when calculating the technical correction to the FMRL.	to issues described in ID# KL.3 above and ID# KL.13 and ID# KL.14 in table 5, using historical data (1990–2009) of forest land remaining forest land, as recalculated according to recommendations to issues described in ID# L.8 and ID# L.10 above and in ID# L.31 and ID# L.32 in table 5, and the age-class distribution of 2009.
KL.7	Forest management – CO_2, CH_4 and N_2O (KL.8, 2016) Accuracy	Implement a technical correction to the FMRL in order to ensure consistency among areas of forest land included in the FMRL and areas reported under FM during the commitment period.	Not resolved. During the review, Ukraine stated that the technical correction to ensure consistency for forest area will be implemented together with the technical correction described in ID# KL.6 above.
KL.8	Forest management – CO_2, CH_4 and N_2O (KL.9, 2016) Transparency	Report the definitions of "natural forest" and "planted forest" as per the IPCC good practice. The Party may consider the definition of "planted forest" as provided by FAO and may define "natural forest" as all forests that do not conform to the definition of "planted forest".	Resolved. Definitions of "natural forest" and "planted forest" have been reported in the NIR (chapter 11.1.1).
KL.9	Forest management – CO_2 (KL.10, 2016) Accuracy	Apply the default methodology contained in the Kyoto Protocol Supplement (equations 2.8.2 and 2.8.3) for estimating the contribution of HWP, including the equations to estimate and exclude from the accounting the HWP domestically produced with imported wood.	Resolved. The ERT noted that the IPCC default method and factors have been applied consistently in line with good practice for estimating the contribution of HWP.
KL.10	Forest management – CO_2, CH_4 and N_2O (KL.12, 2016) Transparency	Report the FM cap in the CRF accounting tables to ensure the correct quantification of credits accounted for under FM.	Resolved. The value of the FM cap has been filled in the CRF accounting table (262,671.177 kt CO_2 eq).
KL.11	N_2O emissions from N mineralization/ immobilization due to carbon loss/gain associated with land-use conversions and management change in mineral soils – N_2O (KL.13, 2016) Accuracy	Exclude areas with a net SOC increment from the calculation of N_2O emissions from N mineralization associated with SOC losses in afforested lands.	Resolved. The ERT noted that according to the IPCC tier 1 methodology applied by Ukraine for the calculation of N_2O emissions from N mineralization, avoided N_2O emissions from areas with a net SOC increment have not been reported.
KL.12	N_2O emissions from N mineralization/ immobilization due to carbon loss/gain associated with land-use conversions and management change in mineral soils – N_2O (KL.14, 2016)	Report, in CRF table 4(KP-II)3, indirect N_2O emissions together with direct N_2O emissions originating from N mineralization associated with net SOC loss in mineral soils (see the 2006 IPCC Guidelines, volume 4, chapter 11, equation 11.10) and report, in the NIR, indirect N_2O emissions disaggregated from direct N_2O	Resolved. The ERT noted that direct and indirect N_2O emissions have been reported together in CRF table 4(KP-II)3. The ERT also noted that direct and indirect N_2O emissions from SOM mineralization have been reported separately in the NIR (chapter 11.3.1).

ID[a]	Issue and or problem classification[a]	Recommendation made in previous review report	ERT assessment and rationale
	Completeness	emissions.	

[a] References in parentheses are to the paragraph(s) and the year(s) of the previous review report(s) where the issue and/or problem was raised. Issues are identified in accordance with paragraphs 80–83 of the UNFCCC review guidelines and classified as per paragraph 81 of the same guidelines. Problems are identified and classified as problems of transparency, accuracy, consistency, completeness or comparability in accordance with paragraph 69 of the Article 8 review guidelines, in conjunction with decision 4/CMP.11.

IV. Issues identified in three successive reviews and not addressed by the Party

8. In accordance with paragraph 83 of the UNFCCC review guidelines, the ERT noted that the issues included in table 4 have been identified in three successive reviews, including the review of the 2017 annual submission of Ukraine, and have not been addressed by the Party.

Table 4
Issues identified in three successive reviews and not addressed by Ukraine

ID[a]	Previous recommendation for the issue identified	Number of successive reviews issue not addressed[a]
General		
	No such general issues were identified	
Energy		
E.2	Develop and use country-specific CO_2 EFs for liquid fuels (i.e. residual fuel, diesel oil, LPG, petroleum coke and refinery gases) which have a significant share in the fuel mix of stationary combustion	4 (2014–2017)
E.6	Investigate the allocation of emissions from the combustion of lubricants and report the outcome of this assessment	3 (2015–2017)
E.7	Strive to collect data for biodiesel consumption for the period 1990–2012 and report the outcome of those efforts in the NIR and, if impossible, change the notation key for the period 1990–2012 from "NO" to "NE"	3 (2015–2017)
IPPU		
I.4	Report consistently the information on the tier applied to estimate N_2O emissions from adipic acid production and include in the NIR the description of the number and type of abatement systems used in Ukraine and the corresponding destruction and utilization factors	3 (2015–2017)
I.7	Include information on aluminium production in the NIR, covering the relevant time period, as required by the UNFCCC Annex I inventory reporting guidelines	3 (2015–2017)
I.8	Investigate further disposal emissions, noting that the average lifetime for air-conditioning equipment according to the 2006 IPCC Guidelines is between 10 and 20 years, and document the analysis in the NIR	3 (2015–2017)
Agriculture		
	No such issues for the agriculture sector were identified	
LULUCF		
L.2	For the model used to calculate the net changes in SOM in mineral soils, verify the model's outputs with measurements annually conducted in the country	4 (2014–2017)

ID[a]	Previous recommendation for the issue identified	Number of successive reviews issue not addressed[b]
L.5	Enhance the information reported in the NIR to improve transparency and include, for each estimated category, the verification of outputs (i.e. GHG estimates), if any, noting that the verification of outputs is mandatory for tier 3 estimates	3 (2015–2017)
L.8	Report all areas that are included under forest land and that are unstocked because of management activities (e.g. firebreaks, forest roads, etc.) under the category managed forest land, possibly under a subdivision such as "unstocked managed forest land", or alternatively according to their dominant use (e.g. firebreaks as grassland and forest roads as settlements)	3 (2015–2017)
L.9	Revise the calculations of GHG emissions and removals from forest land in mineral soils following the methods presented in the 2006 IPCC Guidelines and implement sector-specific QC procedures to ensure the accuracy of the estimates reported across the time series	3 (2015–2017)
L.10	Revise the estimates of DOM and establish sector-specific QC procedures to check the time-series consistency of the estimates and their coherence among carbon pools and categories	4 (2014–2017)
L.14	Enhance data collection on the use under which organic soils are reported, and supplement the current data gaps with available ancillary data and expert judgment, where needed, to ensure that no systematic errors affect the estimates of GHG emissions in the time series	3 (2015–2017)
L.19	Enhance the data collection on the drainage status of peat production sites once abandoned; supplement the current data gaps with available ancillary data and expert judgment where needed; and estimate GHG emissions in sites for peat production which, although abandoned, are still under drainage to ensure that no errors affect the GHG emission trend	3 (2015–2017)
L.25	Revise the classification of category 66 ("dry open lands with special vegetation cover"), noting that category 66 appears to more closely match the definition of the IPCC category grassland than other land	3 (2015–2017)
L.26	Strengthen the QC procedures for the LULUCF sector (correct the 1990 value for the SOM CSC factor for mineral soils) and report on the improvements implemented	3 (2015–2017)
L.27	Subdivide and report separately deforested areas between those that did contain trees and those that did not contain trees before deforestation; report in the NIR a table where, for each carbon pool, the standing carbon stocks before deforestation and after deforestation are reported for those lands that did contain trees before deforestation	3 (2015–2017)
Waste		
	No such issues for the waste sector were identified	
KP-LULUCF[a]		
KL.1	Report in the NIR additional information on the model applied to estimate the SOM CSCs in land converted to forest land, as well as a table where the areas converted to forest land and the CSCs in each carbon pool are reported, stratified by land-use conversion type, climatic zone and year of conversion	3 (2014–2017)
KL.2	Report in the NIR additional information on how the CSC factors applied to estimate the CSCs in forest land converted to other land use are calculated, as well as a table where the areas converted to forest land and the CSCs in each carbon pool are reported, stratified by land-use conversion type, climatic zone and year of conversion	3 (2014–2017)

[a] The review of Ukraine's 2015 annual submission was under the Convention only and not subject to review procedures under the Kyoto Protocol. As such, the information reported by Ukraine related to KP-LULUCF activities was not reviewed in 2015 and therefore 2015 is not included in the counting of successive reviews.

V. Additional findings made during the 2017 individual inventory review

9. Table 5 contains findings made by the ERT during the individual review of the 2017 annual submission of Ukraine that are additional to those identified in table 3.

Table 5
Additional findings made during the 2017 individual review of the annual submission of Ukraine

ID[a]	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and or a problem[20] If yes, classify by type*
General			
G.7	QA/QC and verification	The NIR comprehensively describes the QA/QC plan and procedures in chapter 1.2.3 (pp.32–44). However, the ERT notes a number of inconsistencies between the reporting in the NIR and the CRF tables in all sectors, which indicates that tier 1 QC procedures were not implemented in a fully appropriate manner. For instance, the ERT identified some typographical mistakes, incorrectly referenced sources, inconsistent time series of EFs, specifically in the agriculture and LULUCF sectors and inconsistent use of notation keys. Also, the following inconsistencies were noticed between the information provided in the NIR and that included in CRF table summary 3: for energy industries, the NIR indicates the use of tier 1 methods for estimates of CH_4, while the CRF table indicates the use of tier 1 and tier 3; for enteric fermentation, the NIR indicates the use of country-specific and default EFs for estimates of CH_4, while the CRF table indicates the use of country-specific EFs; for agricultural soils, the NIR indicates the use of tier 2 methods for estimates of N_2O, while the CRF table indicates the use of country-specific and tier 2 methods; for grassland (biomass burning), the NIR indicates the use of tier 1 and country-specific methods for estimates of CH_4 and N_2O, while the CRF table indicates the use of tier 1; for wetlands (land converted to wetlands), the NIR indicates the use of default and country-specific EFs for estimates of CO_2, while the CRF table indicates the use of default EFs; for wetlands (biomass burning), the NIR indicates the use of tier 1 and country-specific methods for estimates of N_2O, while the CRF table indicates the use of tier 1; for settlements (land converted to settlements), the NIR indicates the use of tier 1 methods for estimates of CO_2, while the CRF table indicates the use of tier 1 and country-specific methods; and for other land (land converted to other land), the NIR indicates the use of tier 1 methods for estimates of CO_2, while the CRF table indicates the use of tier 1 and country-specific methods. During the review, Ukraine noted that in its next annual submission all inconsistencies will be eliminated. The ERT recommends that Ukraine improve and implement the QC procedures as described in its QA/QC plan in order to minimize mistakes and inconsistencies, incorrectly referenced sources and inconsistent use of notation keys and to ensure a better time-series consistency of its GHG inventory estimates, specifically in the agriculture and LULUCF sectors.	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
G.8	National system	The ERT notes that the national system meets most of the requirements of the annex to decision 19/CMP.1 in conjunction with decisions 3/CMP.11 and 4/CMP.11, with the exception of those specified in paragraphs 10(b), 10(e), 14(c) and 14(f), which require that, in the implementation of its national system, each Party included in Annex I shall, respectively, ensure sufficient capacity for the timely performance of the functions defined in the guidelines for national systems, including data collection for estimating anthropogenic GHG emissions by sources and removals by sinks and arrangements for technical competence of the staff involved in the inventory development process; provide information	Yes. Adherence to reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and or a problem?[a] If yes, classify by type

necessary to meet the reporting requirements defined in the guidelines under Article 7 in accordance with the relevant decisions of the COP and/or the CMP; collect sufficient AD, process information and EFs as are necessary to support the methods selected for estimating anthropogenic GHG emissions by sources and removals by sinks; and compile the national inventory in accordance with Article 7, paragraph 1, and relevant decisions of the COP and/or the CMP.

During the review, Ukraine informed the ERT that because of a lack of financial resources, the data needed to prepare estimates for the 2017 annual submission that would fully meet the transparency, completeness, consistency, comparability and accuracy principles of reporting inventories were not available for the LULUCF sector and KP-LULUCF activities. In addition, the ERT noted that, in the NIR of the 2017 annual submission (p.305), it is reported that "since 2016 year there is a significant challenge in institutional capacity of Ukraine to collect data for Article 3, paragraph 3, activities. Particularly this is connected with financial shortage of the Ukrainian State Project Forest Inventory Production Association 'Ukrderzhlisproekt'".

The ERT also noted that, in particular, the national system of Ukraine was not able to ensure the timely availability of data for the entire time series and the entire national territory of: (1) biomass, deadwood and litter, carbon stocks and CSCs from forest land; and (2) areas of land use and land-use change. Regarding the issue described in point (1), during the review, the State Forest Resource Agency clarified that this issue is also connected with the lack of resources to extract information from databases. The State Forest Resource Agency has stressed, as well, that to ensure quality of reported information on GHG fluxes from forest land across the entire national territory, it would be necessary to collect new and up-to-date data, and this would require the execution of a new national forest inventory. Regarding the issue described in point (2), the ERT noted that the entire land representation of the national territory suffers from a lack of data that allow an accurate assessment of areas of land use and the identification and tracking of areas with land-use changes, as well as areas subject to KP-LULUCF activities. As a result, Ukraine has made extensive use of assumptions and expert judgment, which has a very significant impact on the accuracy of the reported estimates. In particular:

(a) Ukraine used State Forest Resources Agency information to quantify areas under deforestation; however, such information covers only the forest areas under the State Forest Resources Agency administration (i.e. 73 per cent of total national forest area), and the collected information does not identify the new land use to which forest is converted (see ID# KL.13 below);

(b) Ukraine used the information communicated by the State Forest Resources Agency, the Ministry of Infrastructure, the Ministry of Defence and the State Agency of Ukraine on Exclusion Zone Management to quantify afforested areas; however, the information on afforested land does not cover its previous land use, which is unknown;

(c) Although FM areas correspond to areas that have a legal status of forest in the Ukrainian cadastre, such legal status may not correspond to the actual land cover; for instance, it is estimated that,

ID[a]	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem[b]? If yes, classify by type
		in 2015, around 800,000 ha of areas with the legal status of forest had no forest cover, which means that some of the afforestation may have occurred in land already classified as forest and therefore reported under FM instead of under AR activities, with consequences for accounting given the different framework of accounting rules. During the review, Ukraine informed the ERT that it is aware of disruptions in the work of the national system and that it is working on possible solutions with the aim of developing an interministerial and inter-agency plan that will include all actions deemed necessary to adjust the current functions of the national system to ensure that data are collected and provided in a timely manner to prepare the national GHG inventory. Ukraine also expressed interest in obtaining advice from the ERT on elements to be included in the indicated plan. The ERT included this issue in the list of potential problems and further questions raised by the ERT and recommended that Ukraine enhance its national system in order to ensure that the national GHG inventory is able to perform all functions pursuant to the guidelines for national systems for the estimation of anthropogenic GHG emissions by sources and removals by sinks under Article 5, paragraph 1, of the Kyoto Protocol as contained in the annex to decision 19/CMP.1, in conjunction with decisions 3/CMP.11 and 4/CMP.11, regarding the LULUCF sector and KP-LULUCF activities. In particular, the ERT recommended that Ukraine enhance the functions and arrangements in its national system to ensure that: (a) Regarding the issue described in point (1) above, data needed for the land representation are collected and available in a timely manner with the necessary quality to allow the identification and tracking of land uses, management systems and KP-LULUCF activities and their changes in accordance with the relevant IPCC methodological guidance and COP and CMP decisions, as well as to report accurate information on CSCs and associated emissions and removals from forest land; (b) Regarding the issue described in point (2) above, the necessary data from public agencies and administrations are available to prepare GHG estimates and enough human and financial resources are available for the timely performance of all functions related to KP-LULUCF activities. This would mean that the Budget Institution "National Center for GHG Emission Inventory", as the national GHG inventory compiler, can request and receive required data in a timely manner every year. This may require the establishment of a national forest inventory system. The ERT also recommended that Ukraine develop and report on a workplan to enhance the functionality of its national system and resolve the problems identified above. The workplan should address the objectives, characteristics and general and specific functions of the national system of Ukraine, particularly the requirements stipulated in paragraphs 10(b), 10(e), 14(c) and 14(f) of the annex to decision 19/CMP.1, in conjunction with decisions 3/CMP.11 and 4/CMP.11. The workplan should further include institutional, legal and procedural arrangements undertaken by Ukraine for estimating anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal	

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and or a problem?[20] If yes, classify by type
		Protocol and for reporting inventory information and supplementary information under the Kyoto Protocol. The ERT further recommended that Ukraine develop and incorporate specific steps and timelines for the implementation of all activities under the workplan, covering the period 2017–2019, with the aim of resolving the identified problems and making the national system fully functional when reporting the 2019 annual submission and, if possible, earlier. The ERT recommended that Ukraine explain how it strives to ensure the continuity and sustainability of its national system over the entire commitment period of the Kyoto Protocol and in the future. In response to the list of potential problems and further questions raised by the ERT, Ukraine informed that it recognizes the high importance of data collection for land representation to fully meet the requirements of reporting to the UNFCCC and under the Kyoto Protocol. MENR is considering the ongoing work in Ukraine in the field of land cover identification and tracking and anticipates that it will significantly improve the spatial analysis component of the national inventory system by the next reporting cycles: (a) Organizational and structural improvement: MENR plans to involve three highly professional organizations in the national inventory system, namely: (i) The Space Research Institute of the National Academy of Science of Ukraine and the State Space Agency of Ukraine for satellite image data receiving and processing; (ii) The State Land Cadastre of the State Service of Ukraine for Geodesy, Cartography and Cadastre for digital data receiving and processing; (iii) The World Data Center for Geoinformatics and Sustainable Development for additional data for QA/QC for spatial information; (b) MENR plans to expand the spectrum of sources of information to include information from different Ukrainian and international organizations, different sentinels (including multispectral sentinels) and different open information systems; (c) MENR plans to start using modern technologies (geographic information systems, spatial analysis, and satellite image interpretation with the application of corresponding methods (Normalized Difference Vegetation Index, Leaf Area Index, Vegetation Productivity Index, Vegetation Condition Index)). It also plans to introduce CORINE land cover, with the CORINE land cover methodology used by Ireland and Portugal for LULUCF reporting; (d) MENR is taking steps to verify the transition to new technologies: a pilot project with the European Environment Agency is under implementation to enhance knowledge of the CORINE land cover programme on the basis of pilot plots in Ukraine. The project will help to consider whether CORINE land cover can be developed and used in the country for different purposes, including	

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a] If yes, classify by type
		reporting under the Convention and the Kyoto Protocol. Implementation of this pilot project could provide knowledge and personnel abilities to cover the entire territory of the country. Regarding data collection on forestry: after consultations with the State Forest Resources Agency of Ukraine, MENR developed a workplan to collect necessary data on forestry in Ukraine. Particular attention is given to cooperating with the Ukrainian State Project Forest Inventory Production Association, which has the most comprehensive information on forests in Ukraine, including historical data. In accordance with the provided workplan, the expected dates of fulfilment of the planned activities are between December 2017 and July 2018. The ERT considers that the potential problem is being correctly addressed. The ERT reviewed the Party's response and the structure and content of the proposed workplan and considers that these elements may adequately cover the issues raised by the ERT in the description of the potential problem. The ERT provides a recommendation under ID# KL.15 below with the aim of enhancing the actions proposed by Ukraine in its workplan. The ERT also recommends that Ukraine implement the workplan in accordance with the proposed timelines and report in the NIR of its next and subsequent annual submissions on the workplan and on the progress of the implementation of the workplan, explaining in detail the ongoing activities put in place to resolve all the problems identified.	
G.9	Article 3, paragraph 14, of the Kyoto Protocol	The ERT noted that Ukraine has not provided information on whether it introduced changes in its reporting on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol in its 2017 annual submission. During the review, Ukraine acknowledged changes in its reporting under Article 3, paragraph 14, in chapter 15 of the NIR, in which it has provided information on its efforts and contribution to strengthening the capacities of developing countries in climate change prevention by training qualified specialists in the fields of ecology, climatology, meteorology and energy efficiency at universities and graduate schools under the relevant bilateral agreements. The changes are referred to in an update of the list of the memorandums of understanding and agreements on cooperation in science and education between the Ministry of Education and Science of Ukraine with similar ministries of Albania, China, Cuba, Equatorial Guinea, Iraq, Jordan, Kazakhstan, Mongolia, Montenegro, Tajikistan, Turkmenistan and Viet Nam. The ERT concluded that, taking into account the confirmed changes in the reporting, the information provided is complete and transparent. The ERT recommends that Ukraine report any change in its information provided under Article 3, paragraph 14, in accordance with decision 15/CMP.1 in conjunction with decision 3/CMP.11.	Yes. Adherence to reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
Energy			
E.22	1.A.1 Energy industries – all fuels – CO_2, CH_4 and N_2O	In the NIR (pp.76 and 77), Ukraine showed that in recent years about two thirds of GHG emissions stem from solid fuels and the rest come mostly from gaseous fuels (figure 3.6). In figure 3.8 of the NIR, it is shown that GHG emissions per MWh electricity produced since 2007 have always been greater than or equal to 1.0 t CO_2 eq/MWh. However, the ERT notes that modern gas-fired power plants (combined	Yes. Transparency

ID[a]	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and or a problem?[20] If yes, classify by type
		cycle) emit about 0.35 t CO_2 eq/MWh, new hard-coal-fired power plants emit about 0.75 t CO_2 eq/MWh and new lignite-fired power plants emit about 0.95 t CO_2 eq/MWh. Considering that the power plant fleet in Ukraine is not completely new, specific values may be higher. Nevertheless, considering the fuel mix (hard coal/natural gas), the value of 1.0 t CO_2 eq/MWh seems to be high. During the review, Ukraine explained that the value of 1.0 t CO_2 eq/MWh and even higher values are due to the following: (1) all power plant blocks are older than 40–50 years and, in order to extend the lifetime, operating steam temperatures are lower, which leads to a higher fuel consumption; (2) in order to balance the power system in Ukraine, plant load is usually 70 per cent or less, with values in specific periods reaching even less than 40 per cent; and (3) prioritization of reconstruction activities as follows: (a) extension of lifetime, (b) energy efficiency and (c) environmental protection. The ERT recommends that Ukraine describe in the NIR the reasons for the high level of specific fuel consumption (GHG emissions per MWh electricity produced) of power plants since 2007.	
E.23	1.A.3.d Domestic navigation – liquid fuels – CO_2, CH_4 and N_2O	In the NIR (pp.72 and 73), Ukraine explained the derivation of the shares of national and international navigation. The ERT noted that cargo in domestic water transportation featured a significant reduction from 2012 to 2013 (40.1 per cent) and a significant increase in 2015 (33.1 per cent) (see table 3.4 of the NIR). Sea and river transport displayed a similar fluctuation. During the review, Ukraine explained that water transport plays a role of reserve infrastructure and that water levels in rivers in Ukraine are decreasing every year. For this reason, significant fluctuations (e.g. in 2013) may take place. For the year 2015, the increasing trend took place due to a substitution of railway and road transportation due to the special national circumstances in the territory of Ukraine and fluctuations in the national economy for the years 2014–2015. The ERT recommends that Ukraine include in the NIR documentation of the observed trends in cargo for national and international navigation, particularly in the years from 2012 onward.	Yes. Transparency
E.24	1.A.4 Other sectors – all fuels – CO_2, CH_4 and N_2O	In the NIR (pp.96 and 97), Ukraine presented the trends of GHG emissions in the other sectors category. For the strong decreasing trend of GHG emissions in the residential subcategory (GHG emissions decreased by more than half between 1990 and 2015 (–55.3 per cent)), the significant change in the fuel mix towards natural gas is presented as the only reason. The ERT asked Ukraine during the review what other reasons led to such a large decrease of emissions and furthermore requested an explanation for the trend of emissions in the other subcategories and noted that most notably GHG emissions in the commercial/institutional subcategory decreased from 38,727.99 kt CO_2 eq in 1990 to 1,553.41 kt CO_2 eq in 2015. In response to these questions, Ukraine provided several reasons for the trends in the other sectors category. Among other reasons were the decrease of emissions in the residential subcategory owing to population decline, including migration of people abroad; increase of efficiency of heating devices and other energy savings. The decrease of emissions in the commercial/institutional subcategory was explained, inter alia, by the reduction of social infrastructure, savings owing to budgetary restrictions and privatization effects that led to reporting emissions in other categories.	Yes. Transparency

ID[a]	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem[b]? If yes, classify by type
		The ERT recommends that Ukraine include in the NIR clear and detailed explanations for the decreasing trends of total CH4 emissions in the residential and commercial/institutional subcategories of the other sectors category.	
E.23	1.B.2.a Oil – CO_2, CH_4 and N_2O	In the NIR (pp.109–111), Ukraine reported that many of the EFs used for estimating emissions from the oil industry stem from the 2006 IPCC Guidelines and correspond to default values provided for developing countries and countries in transition in the 2006 IPCC Guidelines (volume 2, chapter 4, table 4.2.5). The ERT raised a question during the review as to whether there have been refurbishments in the oil infrastructure since 1990, which may have led to improved operations so that EFs in Ukraine may not correspond to default values provided for that group of countries, but rather those provided for developed countries (volume 2, chapter 4, table 4.2.4 of the 2006 IPCC Guidelines). During the review and in consultation with an external energy expert, Ukraine explained that the infrastructure of the oil industry has not received significant investments for upgrading since 1990, with resulting low efficiencies, significant need for repair and maintenance, etc. Therefore, default EFs relevant to developed countries are not applicable to the country. The ERT recommends that Ukraine include an explanation in the NIR for the choice of CO_2, CH_4 and N_2O EFs for estimating emissions for the oil category, including documentation of the current state of the oil industry infrastructure.	Yes. Transparency
IPPU			
I.10	2.B.4 Caprolactam, glyoxal and glyoxylic acid production – N_2O	Ukraine reported the N_2O emissions from caprolactam, glyoxal and glyoxylic acid production from 1990 to 2013 in CRF tables 2(I).A–H and indicated in the NIR that production of those products in Ukraine has not occurred after 2013. However, the ERT noted that a methodological description for these categories and applied QA/QC procedures were not described in the NIR. In the NIR, Ukraine reported that because this activity is no longer occurring in the country, this information was not included, but it is available in the NIR submitted in 2015. The ERT noted that, according to the reporting requirements, all estimated categories should be described in the NIR, even if the emissions for that category did not occur in the latest reported year. The ERT recommends that Ukraine include in the NIR methodological descriptions and QA/QC procedures regarding N_2O emissions from caprolactam, glyoxal and glyoxylic acid production.	Yes. Transparency
I.11	2.F.1 Refrigeration and air conditioning – HFCs	Ukraine reported in the NIR and CRF table 2(II).B–H, HFC-123a emissions from stocks in subcategory 2.F.1.B domestic refrigeration (4.10 t in 2015); however, disposal emissions were reported as "NO". The ERT noted that the assumed lifetime of the domestic refrigeration equipment is 15 years (table 4.33, p.156 of the NIR). Taking into account that the first operating equipment with HFC-134a was reported in 2000, the first disposal HFC emissions should be reported in 2015 at the latest. During the review, Ukraine explained that disposal emissions from domestic refrigeration were calculated with an assumed lifetime of 18 years for domestic equipment, which is related to the unstable economic situation in	Yes. Transparency

ID[1]	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and or a problem[2]? If yes, classify by type
		Ukraine that negatively influenced and reduced the purchasing ability of the population. The increase of the average lifetime of refrigerators is a result of not replacing equipment and an increase in the amount of services provided to the population for repairing domestic refrigerators. Ukraine also provided documentation on an expert assessment from Cherkasky NIITEKHIM showing 18 years as the average lifetime for domestic refrigeration equipment, which falls within the 2006 IPCC Guidelines default range from 12 to 20 years. Ukraine noted that the mistake in the NIR about the lifetime of the domestic equipment will be corrected in its next annual submission. After an analysis of the information and documents provided during the review, the ERT considered an assumed lifetime of 18 years for domestic refrigeration equipment as reasonable. The ERT recommends that Ukraine correct the data in the table of the NIR presenting assumptions regarding the equipment lifetime used to estimate HFC disposal emissions from domestic equipment to ensure consistency with the assumptions used in the calculations for 2.F.1.B (domestic refrigeration). The ERT also recommends that Ukraine document in the NIR the national circumstances supporting use of an average lifetime of 18 years for domestic refrigeration equipment.	
I.12	2.F.1 Refrigeration and air conditioning – HFCs	In response to a recommendation made in previous review reports, Ukraine for the first time reported HFC emission estimates for subcategory 2.F.1.D transport refrigeration in the CRF tables 2(II).B–H (see ID# I.9 in table 3). However, the ERT had difficulties finding information on the methodological approaches used and the QA/QC procedures for this subcategory and requested clarifications from Ukraine. In its response, Ukraine indicated that information about types of equipment included in the estimates, assumed initial filling, production and operation EFs and expected lifetime are included in the NIR (table 4.33 and chapter 4.25.1.1.2). However, after analysing the information in the NIR, the ERT noted that the information provided in chapter 4.25.1 covering subcategory 2.F.1 refrigeration and air-conditioning equipment is using category identifiers different from the ones provided in the UNFCCC Annex I inventory reporting guidelines (CRF categories identifiers). In the header of table 4.33, subcategory 2.F.1.1 is used, which does not exist in CRF codes (table presented in the NIR has 2.F.1.A commercial refrigeration, 2.F.1.B domestic refrigeration, 2.F.1.C industrial refrigeration, 2.F.1.D transport refrigeration, grouped together). The same problem was identified in table 4.34 covering information about stationary air-conditioning equipment, where subcategory identifier 2.F.1.2 was given instead of 2.F.1.F. In table 4.35, which included information about mobile air conditioning, identifier 2.HA.F.1.6 is given, while CRF tables use the identifier 2.F.1.E for that subcategory. The ERT encourages Ukraine to revise the category codes in the NIR for subcategory 2.F.1 to follow the CRF structure	Not an issue/problem
I.13	2.F.1 Refrigeration and air conditioning – HFCs	In the table of section A8.1 of annex 8 to the NIR (p.566), Ukraine provided information about its actions in response to a recommendation from the previous review report to estimate and include HFC emissions from 2.F.1.D transport refrigeration in the inventory (see ID# I.9 in table 3). In this table, Ukraine indicated that this task requires additional scientific work and will be included in the	Yes. Transparency

ID[a]	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[20] If yes, classify by type
		improvement plan for the next annual submission. However, the ERT noted that in chapter 4.25.1.1 of the NIR and in CRF table 2(II).B–H, HFC emissions from transport refrigeration were estimated and reported. Therefore, during the review, the ERT requested Ukraine to clarify this inconsistency. In its response to the ERT, Ukraine clarified that in the table of section A8.1 of annex 8, an editorial mistake occurred and the mentioned research work is a work designed to improve the quality of the inventory under the whole category 2.F product uses as substitutes for ozone-depleting substances (2.F.1 refrigeration and air conditioning), and for this reason it was included in the improvement plan (table A8.2 of annex 8 to the NIR). The ERT recommends that Ukraine ensure correct descriptions of the actions of the Party in response to recommendations made in previous reports for the IPPU sector, with the aim of reflecting the most updated situation, in particular with reference to table in section A8.1 of annex 8 to the NIR on actions in response to recommendations made in the previous review report and on the improvement plan.	
I.14	2.F.1 Refrigeration and air conditioning – HFCs	In table 4.35 of the NIR (p.162), which refers to assumptions made for subcategory 2.F.1 mobile air conditioning, Ukraine reported that it applied a value of 1,300 for the GWP for HFC-134a used in railway transport and sea and river transport. The ERT noted that this value is lower than the value provided in annex III to the UNFCCC Annex I inventory reporting guidelines (1,430) and that, in the same table, emissions of HFC-134a reported in CO_2 eq seem to be calculated correctly. In its response to the request of the ERT for clarification of this inconsistency, Ukraine noted that there was an editorial mistake in table 4.35 of the NIR and that the values of HFC-134a emissions in CO_2 eq were calculated using the correct GWP of 1,430. The ERT recommends that Ukraine revise the table of the NIR that refers to assumptions made for subcategory 2.F.1.E mobile air conditioning to provide the correct GWP value used in calculations for HFC-134a emissions.	Yes. Transparency
I.15	2.F.1 Refrigeration and air conditioning – HFCs	The ERT noted that for the emission estimates for subcategory 2.F.1 mobile air conditioning the assumed lifetime for automotive vehicles is 18 years, which is higher than the range (9–16 years) given in the 2006 IPCC Guidelines (chapter 7, table 7.9, p.7.52). In the NIR, there is no information about the reasons behind introducing a longer country-specific lifetime. During the review, the ERT requested Ukraine to provide information on national circumstances that supports the assumption of a longer use of equipment before retiring it from the market. In its response, Ukraine indicated that the use of 18 years as the assumed lifetime in estimates for this subcategory for vehicles with air conditioning is related to the fact that, according to statistical studies, in the current unstable economic situation in Ukraine, the small number of sales of new cars and the insignificant importation of old cars with air conditioning into the country led to a significant ageing of the vehicle fleet, which resulted in an average lifetime of cars ranging from 17 to 20 years. As a reference to the applied assumption on the lifetime of vehicles, Ukraine provided to the ERT documentation from Cherkasky NIITEKHIM that the ERT considered satisfactory. Taking into account the national circumstances like the economic situation and	Yes. Transparency

ID[a]	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and or a problem?[b] If yes, classify by type
		cost of new equipment compared to the cost of repairs, the assumed lifetime seems to be reasonable. However, the application of parameters that are out of the range provided by the 2006 IPCC Guidelines should be justified in the NIR. The ERT recommends that Ukraine include in the NIR a clear justification for assuming a longer lifetime (18 years) than the IPCC default value range (9–16 years) for vehicles with mobile air conditioning in the emission estimates for subcategory 2.F.1.E mobile air conditioning.	
I.16	2.F.1 Refrigeration and air conditioning – HFCs	Ukraine reported the first use of cars equipped with air conditioning containing HFC-134a in 2000. This is relatively late when compared with other reporting Parties (Hungary and Estonia – 1992; Lithuania and Romania – 1993; Poland, Slovakia and Latvia – 1995; Czechia – 1997). During the review, the ERT requested Ukraine to clarify the reasons for the late importation of air-conditioned cars into the Ukrainian market. In its response, Ukraine indicated that according to a scientific research study, the importation of air-conditioned cars in Ukraine started in 1998. As data on imports of HFCs in vehicles in Ukraine for 1998 and 1999 are not available, the data obtained from SSSU of the total importation of cars from Europe and other countries were used, which covers all imports, both public and private. As the importation of cars in 1998 and 1999 compared with 2000 was not significant, and accordingly the use of HFCs in automotive air conditioners was also insignificant, a decision was taken for HFC emissions from automobile air conditioners such that 2000 would be the beginning for calculations, as more accurate information started to be available from the year 2000. Ukraine also indicated that according to information on the importation of cars in 1998 and 1999 obtained from SSSU and using extrapolation methods, approximate values of HFC use in automotive air conditioners and the corresponding emissions were determined, which amounted to 0.0001 per cent and 0.0002 per cent, respectively, of total emissions for the country for 1998 and 1999, which indeed did not exceed 0.05 per cent of total national emissions excluding LULUCF. The AD, represented by the stock of existing equipment for 2000, were calculated taking into account the HFCs included in imported automotive vehicles in 1998 and 1999, based on data on the total importation of cars obtained from SSSU. According to Ukraine, the values for 1998 and 1999 can be considered insignificant, in accordance with paragraph 37(b) of the annex to decision 24/CP.19. After the analysis of the documentation provided during review, the ERT considered that there is no underestimation of the emissions for the years 2000–2015. However, the ERT is of the view that Ukraine has not correctly applied the provisions of paragraph 37(b) of the annex to decision 24/CP.19 because the threshold for the significance level can be applied only to new sources not estimated before, but the time series of HFC emissions from vehicles was estimated in previous annual submissions; therefore the ERT considers that HFC emissions for 1998 and 1999 for this subcategory must be estimated. The ERT recommends that Ukraine estimate HFC emissions for 1998 and 1999 for the subcategory mobile air conditioning and include in the NIR information justifying the late introduction of air-conditioned cars into the Ukrainian market, as of the year 2000.	Yes. Completeness

ID[a]	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and or a problem[20] If yes, classify by type
Agriculture			
A.16	3. General (agriculture) – CH_4 and N_2O	The ERT noted that for several parameters and EFs it is specified in the NIR that country-specific values are used, despite the fact that the values are exactly the same as the default values from the 2006 IPCC Guidelines (e.g. maximum CH_4 producing capacity (p.197), EF for organic soils (p.214), EF for N_2O from pasture, range and paddock manure (p.215), $Frac_{GASM}$ (p.216) and $Frac_{LEACH}$ (p.217)). During the review, Ukraine was not able to confirm whether the different parameters and EFs used for the estimates were default values from the 2006 IPCC Guidelines or were country-specific values. The ERT recommends that Ukraine specify accurately all through the agriculture chapter whether the different parameters and EFs used for the estimates are default values from the 2006 IPCC Guidelines or are country-specific. If country-specific values are used, the ERT recommends that Ukraine include in the NIR a summary of how the country-specific value was developed, together with a reference to the study or scientific research source of the parameter.	Yes. Transparency
A.17	3. General (agriculture) – CO_2, CH_4 and N_2O	The ERT noted some errors in the NIR where tables referred to in the text did not exist in the NIR or did not contain the data stated (e.g. table A3.2.3.6 should have contained data on percentage crude protein but did not, and milk production should have been presented in table A3.2.3.8 but this table does not exist). The ERT recommends that Ukraine improve its QC checks to ensure that all tables referred to in the text of the NIR actually exist in the NIR and contain the information stated.	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
A.18	3.A.1 Cattle, 3.B.1 Cattle, 3.D.a.2.a Animal manure applied to soils, 3.D.a.3 Urine and dung deposited by grazing animals and 3.D.b Indirect N_2O emissions from managed soils – CH_4 and N_2O	The ERT noted that between 2014 and 2015 there was a decrease in the average GE by 7.4 per cent from 157.57 MJ/head/day to 145.90 MJ/head/day. This observed decrease in GE was unexpected considering that the general trend of GE values since 2000 was a continuous increase. This issue affected emission estimates of CH_4 from subcategory 3.A.1 cattle – growing cattle, as well as N_2O emissions from subcategories 3.B(b).1 cattle – growing cattle, 3.D.2.a animal manure applied to soils, 3.D.3 urine and dung deposited by grazing animals and 3.D.b indirect N_2O emissions from managed soils. During the review, the ERT requested information from Ukraine that could justify the identified decrease between 2014 and 2015, but no such information could be provided. Hence, the ERT concluded that there is no justification or documentation to support this significant decrease in GE values and, consequently, that the related CH_4 and N_2O emissions could be underestimated for 2015. The ERT therefore included this issue in the list of potential problems and further questions raised by the ERT and recommended that Ukraine provide a clear and documented justification of how this large decrease in the GE values could occur between two subsequent years (2014 and 2015), including documentation on the underlying data and reasons of the decrease. If this was not possible, alternatively the ERT recommended that Ukraine provide revised estimates of CH_4 and N_2O emissions for 2015 for all subcategories with a revised average GE value. This could be done using appropriate corrected AD from SSSU, if this is identified as the reason for the problem; using the extrapolation method based on	Yes. Transparency

ID[a]	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and or a problem[20] If yes, classify by type
		previous GE values, in accordance with the guidance in the 2006 IPCC Guidelines (volume 1, chapter 5) or by correcting the inventory estimation method if that is the source of the issue In response to the list of potential problems and further questions raised by the ERT, Ukraine resubmitted a complete set of CRF tables for 1990–2015 with revised CH_4 and N_2O estimates for 2014 and 2015 for the subcategories indicated above using extrapolation of the estimated feed intake for 2013 for Crimea and parts of Donetsk and Lugansk regions instead of the original values used. As a result, the revised average GEs for growing cattle for 2014 and 2015 are of the same magnitude, instead of the sudden decrease identified during the review. As a result of the revision, the estimated emissions for 2014 decreased by 0.54 kt CO_2 eq (0.0001 per cent of the national total and 0.001 per cent of the agriculture sector total) and increased for 2015 by 257.14 kt CO_2 eq (0.08 per cent of the national total and 0.56 per cent of the agriculture sector total). The ERT agreed with the Party's response. The ERT recommends that Ukraine update in the NIR the description of the methods used to estimate CH_4 and N_2O emissions from subcategory 3.A.1 cattle – growing cattle, as well as N_2O emissions from subcategories 3.B(b).1 cattle – growing cattle, 3.D.2.a animal manure applied to soils, 3.D.3 urine and dung deposited by grazing animals and 3.D.b indirect N_2O emissions from managed soils, providing justification and solid documentation for the updated or new applied feed intake values. In addition, the ERT recommends that Ukraine improve its QC procedures to identify this type of time series break before the inventory is published.	
A.19	3.A.1 Cattle, 3.B.1 Cattle, 3.D.a.2.a Animal manure applied to soils, 3.D.a.3 Urine and dung deposited by grazing animals and 3.D.b Indirect N_2O emissions from managed soils – CH_4 and N_2O	During the review, Ukraine explained that the methodology used to estimate GE for cattle is based on fodder consumption data provided by SSSU and that the data are received in the form of fodder units. Ukraine explained that one fodder unit is the equivalent of the energy intake required, on top of the energy required for maintenance, for an animal to produce 150 g of fat. Ukraine estimates this to correspond to 5.92 MJ. Hence, the ERT noted that data provided by SSSU are in the form of energy, not mass. The ERT also noted that this information is not provided in the NIR. Moreover, in the light of the fact that fodder consumption data are received in energy units, equations 5.1 and 5.2 described in the NIR seem to be redundant. In those equations, GE is instead estimated based on the energy content in 1 kg of different types of feed. The rationale regarding why and how these equations were used in the inventory could not be clearly explained by Ukrainian experts during the review. The ERT believes that future ERTs should consider this issue further to ensure that there is not an underestimate of emissions from these subcategories. The ERT recommends that Ukraine describe in detail how GE is estimated for the different cattle groups, in particular in which unit the AD is received from SSSU and for which fodder and animal categories the data are delivered. Furthermore, the ERT recommends that Ukraine clarify the rationale behind using equations 5.1 and 5.2 of the NIR to calculate GE. The ERT also recommends that Ukraine provide in the NIR a transparent description of the concept of fodder units and how these data are	Yes. Transparency

ID[a]	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem[28] If yes, classify by type
		estimated by SSSU for agricultural enterprises and households holding cattle	
A.20	3.A.1 Cattle, 3.B.1 Cattle, 3.D.a.2.a Animal manure applied to soils, 3.D.a.3 Urine and dung deposited by grazing animals and 3.D.b Indirect N_2O emissions from managed soils – CH_4 and N_2O	The ERT noted that GE is calculated based on fodder consumption data from the SSSU. However, a significant period of the year the cattle spends foraging on pastures. During the review, the ERT was informed that the amount of feed consumed while foraging on pastures is included in the forage consumption data from SSSU; however, no explanation could be given by Ukraine regarding how the amount of feed consumed while foraging on pastures was estimated by SSSU. The ERT believes that future ERTs should consider this issue further to ensure that there is not an underestimate of emissions from these subcategories. The ERT recommends that Ukraine include, in the NIR, information on how the amount of fodder consumed while foraging on pastures is estimated for agricultural enterprises and households holding cattle.	Yes. Transparency
A.21	3.A.1 Cattle, 3.B.1 Cattle, 3.D.a.2.a Animal manure applied to soils, 3.D.a.3 Urine and dung deposited by grazing animals and 3.D.b Indirect N_2O emissions from managed soils – CH_4 and N_2O	The ERT noted that Ukraine reports emissions from cattle in the CRF tables according to option B (i.e. mature dairy cattle, other mature cattle and growing cattle). In section A3.2 of annex 3 to the NIR (pp.444 and 445), Ukraine showed how the different animal species/groups from the official statistics are aggregated into CRF categories. In the group mature dairy cattle, Ukraine included heifers from two years of age and older. The ERT also noted that this is not in agreement with the livestock categorization in table 10.1 of the 2006 IPCC Guidelines, where it is stated that the category mature dairy cow should only include cows that have calved at least once and are used principally for milk production. During the review, Ukraine did not provide a clear explanation on whether this only affects the allocation of emissions between the different cattle categories (and by that, comparability between different Parties) or if a reclassification also may lead to a downward revision of emission estimates from cattle as a whole. The ERT recommends that Ukraine specifically allocate mature heifers to the category other mature cattle and ensure that the classification used in the inventory is in agreement with the guidance in table 10.1 of the 2006 IPCC Guidelines.	Yes. Accuracy
A.22	3.B Manure management – CH_4	The ERT noted that the amount of VS produced in poultry manure has been recalculated by Ukraine since the last submission for the whole times series, because the revision of country-specific dm values according to the expert judgment from the National Academy of Agricultural Sciences of Ukraine. In the revised time series, the amount of VS increased by between 266.6 per cent and 278.3 per cent since the last annual submission. Moreover, the revised VS excretion rate values (ranging from 0.1746 kg dm/head/day to 0.1590 kg dm/head/day) were significantly higher than the default value of 0.02 kg dm/head/day from the 2006 IPCC Guidelines and were the highest of all reporting Parties (ranging from 0.0088 kg dm/head/day to 0.0300 kg dm/head/day). During the review, Ukraine did not provide further explanations on this issue. It is the view of the ERT that, as a consequence of this higher VS excretion	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and or a problem? If yes, classify by type
		rate values, the CH_4 emissions from category 3.B manure management are most likely overestimated. The ERT recommends that Ukraine investigate the accuracy of the VS excretion rate values used in the estimates for the amount of VS produced by poultry for the entire time series and, if errors are identified, recalculate the complete time series and revise accordingly its CH_4 estimates for category 3.B manure management, including in the NIR clear explanations and sources on the parameters used and rationale for any recalculations made.	
A.23	3.B Manure management – N_2O	The ERT noted that information in the NIR regarding the reported MMS classification was not fully transparent. During the review, Ukraine informed the ERT that the distribution between the different MMS is solely based on the size of the cattle and swine enterprises. Concerning swine, all enterprises containing a maximum of 1,000 animals are assumed to store all the manure as solid, enterprises between 1,001 and 5,000 animals are assumed to use only liquid systems, and enterprises above 5,000 swine are assumed to use only lagoons. Concerning cattle, all enterprises with up to 1,000 animals are assumed to use only solid systems, and enterprises with more than 1,000 animals are assumed to use only liquid systems. The ERT noted that this information is lacking in the NIR. Moreover, Ukraine did not provide a justification on why these assumptions are considered valid. The ERT recommends that Ukraine include in the NIR information on how the distribution between the MMS is estimated, together with a reference to the expert(s) or organization(s) behind these assumptions. Also, the ERT recommends that Ukraine include in the NIR an explanation regarding why it is considered valid to assume that the animal population size of the enterprise is directly correlated with the type of MMS implemented.	Yes. Transparency
A.24	3.B.1 Cattle – N_2O	The ERT noted that Ukraine has revised the methodology for estimating Nex and used the methodology suggested in the 2006 IPCC Guidelines (see ID# A.8 in table 3). However, the Nex values in the revised times series are high compared with the default values. For example, the Nex value reported for mature dairy cattle in 2015 is 133.65 kg N/head/year, while the default value for Eastern Europe is 70.26 kg N/head/year. Moreover, when considering the amount of N excreted per kg of produced milk, Ukraine reported a significantly higher value (28.31 g N/kg milk yield) than the mean value reported by other Parties (17.02 g N/kg milk yield). Concerning growing cattle and other mature cattle, the Nex values reported by Ukraine are the highest of all reporting Parties that have chosen to report according to option B (growing cattle: 79.13 kg/head/year for Ukraine in 2015, while for other Parties it ranges from 15.21 kg/head/year to 50.12 kg/head/year; other mature cattle: 98.00 kg/head/year for Ukraine in 2015, while for other Parties it ranges from 42.24 kg/head/year to 80.00 kg/head/year). During the review, Ukraine did not provide further explanations on this issue. The ERT recommends that Ukraine further justify and thoroughly document in the NIR the Nex values used for the calculations, or reconsider the Nex values used for the different cattle categories and make necessary corrections.	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[20] If yes, classify by type
A.25	3.B.4 Other livestock, 3.D.a.2.a Animal manure applied to soils, 3.D.a.3 Urine and dung deposited by grazing animals and 3.D.b Indirect N_2O emissions from managed soils – N_2O	The ERT noted that for estimating the annual average Nex values for the category other livestock (i.e. goats, horses, mules, camels and buffaloes), Ukraine used the IPCC tier 1 method with default Nex values presented in table 10.19 of the 2006 IPCC Guidelines. These rates are presented in units of N excreted per 1,000 kg animal mass per day and can be applied to the different livestock categories using equation 10.30 of the 2006 IPCC Guidelines. The ERT also noted that in its 2017 annual submission, Ukraine has incorrectly interpreted the unit for Nex values in table 10.19 as kg N/head/year. Consequently, the ERT concluded that N_2O emissions from subcategories 3.B.4 other livestock, 3.D.2.a animal manure applied to soils, 3.D.3 urine and dung deposited by grazing animals and 3.D.b indirect N_2O emissions from managed soils are incorrectly calculated and therefore underestimated for all years of the time series and included this issue in the list of potential problems and further questions raised by the ERT. The ERT recommended that Ukraine revise the Nex values by applying correct units and using equation 10.30 of the 2006 IPCC Guidelines and TAM for the different livestock categories for its inventory estimates. The ERT considered it preferable to use country-specific TAM values, but if no such values can be obtained, IPCC default values could be used, which are provided in the 2006 IPCC Guidelines (annex 10A.2, tables 10A-4 to 10A-9). The ERT also recommended that Ukraine provide, together with the revised estimates for all N_2O emissions affected by the change in Nex values, documentation of the values used as TAM and the revised Nex values. In response to the list of potential problems and further questions raised by the ERT, Ukraine resubmitted a complete set of CRF tables for the years 1990–2015 with revised N_2O estimates for the subcategories indicated above using equation 10.30 of the 2006 IPCC Guidelines and default TAM. As a result of the revision, the estimated emissions for 1990 increased to a total of 298.17 kt CO_2 eq (0.03 per cent of the national total and 0.28 per cent of the agriculture sector total) and the estimated emissions for 2015 increased to a total of 180.41 kt CO_2 eq (0.06 per cent of the national total and 0.39 per cent of the agriculture sector total). The ERT agreed with the Party's response. The ERT recommends that Ukraine update in the NIR the description of the methods used to estimate N_2O emissions from 3.B.4 other livestock, 3.D.2.a animal manure applied to soils, 3.D.3 urine and dung deposited by grazing animals and 3.D.b indirect N_2O emissions from managed soils, and in particular provide information on revised Nex values calculated using equation 10.30 of the 2006 IPCC Guidelines and appropriate TAM values for the different livestock categories.	Yes. Transparency
A.26	3.B.5 Indirect N_2O emissions – N_2O	The ERT noted that Ukraine reports N volatilization from agricultural sources under CLRTAP. The ERT further noted that the reported total N volatilized as NH_3 and NOx differs significantly between the UNFCCC and CLRTAP. For example, for 2015, the value reported in CRF table 3.B(b) is 242.94 kt N, while the value reported under CLRTAP is 12.24 kt N (see ID# A.26 in the 2016 annual review report). During the review, Ukraine did not provide further explanations on this matter. The ERT encourages Ukraine to coordinate the N volatilization estimates reported under CLRTAP and	Not an issue/problem

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and or a problem?[20] If yes, classify by type
		under the UNFCCC in its future reporting by choosing the most appropriate methodology and documenting it as necessary.	
A.27	3.D.a.2.c Other organic fertilizers applied to soils – N_2O	According to the NIR (p.211), SSSU indicated that no N from "other organic fertilizers" is applied to agricultural soils in Ukraine. However, in the CRF tables, for subcategory 3.D.2.c, Ukraine reports both the emissions of N_2O and the amount of N applied to soil under this subcategory (0.02 kt N_2O and 1.18 kt N/year). During the review, Ukraine informed the ERT that the reported emissions were from the application of digestate from composting.	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
		The ERT recommends that Ukraine revise the NIR to reflect the reporting of AD and emissions from other organic fertilizers in agreement with the CRF tables.	
A.28	3.D.a.3 Urine and dung deposited by grazing animals – N_2O	In CRF table 3.B(b), Ukraine reported the notation key "IE" instead of AD on N excretion for the pasture, range and paddock MMS. Ukraine explained in a cell comment in CRF table 3.B(b) that all emissions are reported accordingly in CRF table 3.D (subcategory 3.D.a.3).	Yes. Transparency
		To make it possible to follow the N flux through the inventory, the ERT recommends that Ukraine report N excretion in CRF table 3.B(b) for all MMS, including pasture, range and paddock.	
A.29	3.D.a.5 Mineralization/immobilization associated with loss/gain of SOM – N_2O	The ERT noted that chapter 5 (agriculture) of the NIR did not include a description on the method used to estimate N_2O emissions for subcategory 3.D.a.5 mineralization/immobilization associated with loss/gain of SOM. During the review, Ukraine did not provide further explanations on this issue.	Yes. Transparency
		The ERT recommends that Ukraine include in the NIR a description of the method used to estimate N_2O emissions for subcategory 3.D.a.5 mineralization/immobilization associated with loss/gain of SOM.	
A.30	3.D.a.6 Cultivation of organic soils (i.e. histosols) – N_2O	The ERT noted that Ukraine uses the 2006 IPCC Guidelines to estimate N_2O emissions from organic soils. The 2013 Wetlands Supplement contains updated EFs for direct N_2O emissions from drained organic soils in all land use (see ID# A.27 in the 2016 annual review report).	Not an issue/problem
		The ERT encourages Ukraine to use updated EFs for organic soils from the Wetlands Supplement.	
A.31	3.G Liming – CO_2	Ukraine reported that only "ground lime" is used for liming of soils, and data are provided in table A3.2.6.1 of the NIR. The ERT noted that ground lime may contain a proportion of inert material (see ID# A.29 in the 2016 annual review report).	Yes. Accuracy
		The ERT recommends that Ukraine conduct an assessment on the proportion of inert materials in the ground lime and document the results in the NIR. If the ground lime is considered to include inert materials, the ERT recommends that Ukraine revise the CO_2 emissions for the entire time series, excluding the portion of the inert material in the ground lime.	
LULUCF			

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and or a problem?[20] If yes, classify by type
L.30	4. General (LULUCF) – CO_2, CH_4 and N_2O	The ERT noted that the total area of organic soils reported by Ukraine varies continuously across the time series, from 3,982.480 kha in 1990 to 4,015.258 kha in 2015, although data on organic soils area are not collected annually. Further, the area of cultivated organic soils in table A3.2.5.4 of the NIR and that reported in CRF table 3.D under the agriculture sector differs from that reported in CRF tables 4.B (cropland) and 4.C (managed grassland) for the years 1992 (485.0 kha and 484.9 kha, respectively) and 2011–2012 (487.8 kha and 488.0 kha, respectively). As a cross-check, the ERT noted that the emissions database of the FAO (FAOSTAT) has identified 669 kha organic soils under cropland and 127 kha organic soils under managed grassland by overlapping the harmonized world soil database (http://webarchive.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/) with the Joint Research Centre global land cover map (http://forobs.jrc.ec.europa.eu/products/glc2000/glc2000.php). In addition to the recommendation in ID# L.14 in table 3, which applies only to cropland, the ERT recommends that Ukraine enhance data collection on the other land uses under which organic soils are reported, on their status, either drained or rewetted or, for wetlands only, natural conditions, and supplement the current data gaps with available ancillary data and expert judgment to ensure that no systematic errors affect the estimates of GHG emissions in the time series of each land-use category. Furthermore, the ERT recommends that Ukraine use methods and factors contained in the Wetlands Supplement for estimating CO_2 emissions and removals, as well as CH_4 and N_2O emissions from organic soils (see ID# L.35 below).	Yes. Accuracy
L.31	Land representation – CO_2, CH_4 and N_2O	The ERT noted that CRF table 4.1 has been compiled with cumulative areas in land-conversion categories, while annual areas need to be reported. The ERT also noted that in each year of the time series (i.e. 1990–2015), the area of a land-conversion category reported in any of the CRF tables 4.A–4.F has to be the cumulated area converted to that category over a 20-year period. However, the areas reported by Ukraine under the conversion categories accumulate a variable number of years of conversion; indeed, the area reported for the year 1990 is just the area converted in that year, while in the following years the area reported is the cumulated area since 1990, so growing year by year from 2 years of cumulated area in 1991, 3 years in 1992 and so on until 20 years in 2009 and for all subsequent years. Such an asymmetric accumulation results in artefact trends in GHG emissions and removals. The ERT recommends that Ukraine report annual land-conversion areas in CRF table 4.1 and report cumulated 20-year conversion areas in CRF tables 4.A–4.F, which implies the calculation of annual land use and land-use change matrices for the years 1971–1989. Furthermore, the ERT recommends that Ukraine ensure that in any year X of the GHG inventory time series: (1) the area (A_X) of any land-remaining category A is the area of A in the previous year (A_{X-1}) minus the area of A converted in the year X to all other land-use categories (A to OLU_X) plus the area converted to A from all other land-use categories 20 years before (OLU to A_{X-20}) (i.e. $A_X=A_{X-1}$–A to OLU_X+OLU to A_{X-20}); and (2) the area of any land-converted category B to A (B to A_X) is the cumulated area converted to category A from B (B to A) in the 20-year time period from year X to year X–19 (i.e. B to $A_X=\sum_{x-19}^{x}$ B to A).	Yes. Consistency

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and or a problem[20] If yes, classify by type*
L.32	4.A Forest land – CO_2	The ERT noted that the issue raised on biomass and DOM CSC factors (see ID# KL.6 in table 3) regarding their calculation from limited and not disclosed data sets, which furthermore are not stratified according to age-class structure, applies also to GHG estimates of forest land remaining forest land and land converted to forest land under the Convention. The ERT recommends that Ukraine recalculate nationwide CSC factors for biomass increments and for DOM net changes, stratified by forest type, ecological region and age class by compiling available information in the country and where feasible by collecting novel data through a national forest inventory system. While new CSC factors are being calculated, and noting that Ukraine referenced the use of Buksha et al.'s (2007) report in its 2017 annual submission, the ERT recommends that Ukraine use data contained in table 3.9 (p.126) of Buksha et al.'s (2007) report for biomass increments as stratified by age class and main forest species, together with an age-class distribution for the entire time series 1990–2016 and revise the DOM CSC factors and method to ensure time-series consistency.	Yes. Accuracy
L.33	4.A.1 Forest land remaining forest land – CO_2	The ERT noted that because forest land remaining forest land is a key category, a higher-tier method to estimate the CSCs in mineral soils should be applied, unless Ukraine demonstrates that net emissions/removals from SOM are not significant. Ukraine acknowledged in the NIR (chapter 6.2.2) that sufficient data are not available to prepare tier 2 estimates of SOC changes in mineral soils of forest land remaining forest land. Furthermore, the ERT has established that the Ukrainian national system suffers from a lack of resources (see ID# G.8 above), which impedes its fulfilment of reporting requirements. The ERT acknowledged that Ukraine has included the issue in the list of improvements to be implemented, although with no priority. The ERT concluded that, in accordance with the 2006 IPCC Guidelines (volume 1, decision tree 4.1, section 4.1.2), in the absence of resources, the preparation of a tier 1 estimate is consistent with good practice, especially if applied to a non-significant subcategory (i.e. carbon pool). The ERT encourages Ukraine to assess and report in its future annual submissions whether the limitation in resources for implementing a robust data-collection system for the LULUCF sector has been overcome, so that additional resources may be allocated to collect data on SOC changes in mineral soils to prepare higher tier method estimates or, alternatively, to report information that demonstrates that SOM is not a significant carbon pool.	Not an issue/problem
L.34	4.C.1 Grassland remaining grassland – CO_2	According to the IPCC definition, unmanaged grassland should include land that is not, and has never been, subject to any human activity. The ERT noted that Ukraine reports a large area of unmanaged grassland (i.e. 6,108.99 kha) in 2015. However, the ERT considered all grassland of Ukraine to have been subject to human activities, although with different degrees of intensity across time, owing to the historical intensity of human activities in the country. The ERT recommends that Ukraine: report under unmanaged grassland only those areas that have never been subject to human activities; use subdivisions of the managed grassland to report those areas of grassland that are not subject to changes in management activities or for which management activities	Yes. Accuracy

ID[a]	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and or a problem?[20] If yes, classify by type
		do not result in net emissions or net removals of GHG; and document in the NIR why the reported unmanaged grassland areas are respectively considered unmanaged.	
L.35	4.D.2 Land converted to wetlands – CO_2, CH_4 and N_2O	The ERT noted that Ukraine did not report emissions and removals from SOM in land converted to wetlands. However, in the absence of spatially explicit data, it is a valid assumption to assign all land converted to wetlands to organic soils. Therefore, in the absence of spatially explicit information, the ERT recommends that Ukraine report all land converted to wetlands under the organic soils subdivision and discount such areas from the original land-use category area of drained organic soils. Furthermore, as Ukraine is applying information from the Wetlands Supplement, the ERT recommends that Ukraine apply methods and factors contained in this supplement to estimate GHG emissions and removals from organic soils in land converted to wetlands.	Yes. Completeness
L.36	4(IV) Indirect N_2O emissions from managed soils – N_2O	The ERT noted that indirect N_2O emissions have not been reported in CRF table 4(IV) ("NO" and "NE") because they are assumed to be insignificant (see table 6.5 of the NIR). However, the ERT also noted that indirect N_2O emissions have been correctly reported under the Kyoto Protocol in CRF table 4(KP-II)3, for which AD and emissions are shown in table 11.2 of the NIR. Consequently, to ensure consistency among GHG estimates reported under the Convention and the Kyoto Protocol, the ERT recommends that Ukraine report estimates of indirect N_2O emissions in CRF table 4(IV).	Yes. Completeness
Waste			
W.7	5. General (waste) – CO_2, CH_4 and N_2O	The ERT identified that the description of the solid waste management practices in the NIR is very limited, which does not ensure enough clarity on all practices occurring in the country (e.g. recycling, open burning, management of hazardous waste and wastewater sludge). The ERT recommends that Ukraine improve the description in the NIR of the solid waste management practices in the country, including landfilling of MSW (with and without CH_4 recovery), composting, incineration, recycling, management of hazardous waste and so on.	Yes. Transparency
W.8	5. General (waste) – CO_2, CH_4 and N_2O	The ERT identified that the description of the pathways of different types of waste among the categories of the waste sector (e.g. sludge from wastewater treatment, composted MSW, incinerated hazardous waste) and/or among other sectors such as energy and agriculture, is very limited in the NIR, which prevents seeing the whole movement of all types of waste generated in the country and their final destination. The ERT recommends that Ukraine revise the schematic representation of waste treatment (figure 7.3 in the NIR) by including all categories (in all relevant sectors), the sources of each type of waste, ways of treatment and final destination, particularly of sludge from wastewater treatment.	Yes. Transparency

ID[a]	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and or a problem[m] If yes, classify by type*
W.9	5. General (waste) – CO_2, CH_4 and N_2O	The ERT identified some cases of incorrect use of notation keys for AD and emissions in the CRF tables (e.g. "NA" was used instead of "NO" for 5.A.1.b managed waste disposal sites – semi-aerobic and 5.A.3 uncategorized waste disposal sites; "NA, NE" was used instead of "NE" for 5.C.2 open burning of waste). Also, in the additional information box of CRF table 5.D, the notation key "NA" was used for the parameters $F_{SOS,CON}$, $F_{IND,COM}$ and T_{PLANT}, while some of these values were provided in the NIR (chapter 7.5.3.2.3 and table 7.14). The ERT recommends that Ukraine apply notation keys consistent with the definitions provided in decision 24/CP.19, annex I, paragraph 37, and ensure consistency between the NIR and CRF tables, in particular for subcategories 5.A.1.b managed waste disposal sites – semi-aerobic, 5.A.3 uncategorized waste disposal sites and 5.C.2 open burning of waste, as well as in the additional information box of CRF table 5.D.	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
W.10	5.A.1 Managed waste disposal sites – CH_4	The ERT noted that it is stated in the NIR and shown in CRF table 5.A that CH_4 flaring and recovery take place in some landfills in the country and that the recovered gas is used for energy purposes. The NIR does not specify the destination of the recovered gas used in the energy sector. During the review, Ukraine provided additional documentation from the landfill operators (treated as confidential) certifying the amounts of recovered and flared CH_4 reported in CRF table 5.A. Also during the review, representatives of SSSU provided evidence on the amount of recovered CH_4 and the end-user entities that used it for energy purposes. The ERT recommends that Ukraine enhance the transparency of reporting by providing in the NIR additional information on CH_4 recovery and flaring practices (e.g. documentation that outlines the procedures and certifications on the amount of CH_4 flared and the amount recovered for delivery to the end users), as well as relevant evidence on how and where recovered CH_4 is used in the energy sector.	Yes. Transparency
W.11	5.C Incineration and open burning of waste – CO_2, CH_4 and N_2O	The ERT noted that the NIR indicated that three types of non-biogenic waste have been considered for emission estimates in this category: municipal, industrial and clinical. It has been clarified that the industrial waste comprises lubricants, solvents, waste oil and some hazardous wastes (i.e. waste that contains polychlorinated biphenyl). Although some hazardous wastes are included in industrial waste, the NIR does not describe properly the management practices regarding how hazardous wastes are treated in the country. The ERT identified during the review that the Ukrainian waste collecting system considers four classes of hazardous waste, but SSSU accounts them in an aggregated manner. The ERT acknowledged the likely insignificance of the amount of hazardous waste incinerated, as stated by Ukraine, and the limited impact on total GHG emissions from waste incineration, even with/when using EFs for industrial waste. The ERT encourages Ukraine to include in the next NIR a section describing the hazardous waste management practices in Ukraine to explore the possibility of reporting separately the emissions originated from all types of hazardous waste incineration using the corresponding EFs available for	Not an issue/problem

ID	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? If yes, classify by type
		hazardous waste.	
W.12	5.C.2 Open burning of waste – CH_4 and N_2O	The ERT noted the lack of clarity in the NIR regarding the information on where CH_4 and N_2O emissions from waste incineration under subcategory 5.C.1 non-biogenic were included (in CRF table 5.C, respective emissions are reported as "IE"). During the review, Ukraine informed the ERT that these emissions were reported in the energy sector (subcategory 1.A.1.a public electricity and heat production). The ERT recommends that Ukraine provide in the NIR and CRF table 9 information clarifying under which category it has included CH_4 and N_2O emissions, if these are reported as "IE" (e.g. emissions from incinerated non-biogenic waste).	Yes. Transparency
W.13	5.D Wastewater treatment and discharge – CH_4	Ukraine has reported CH_4 emissions from subcategories 5.D.1 domestic wastewater and 5.D.2 industrial wastewater using country-specific AD and a tier 2 methodology. The ERT noted, however, that there is no sufficient clarity on wastewater sources and on the selection of county-specific values of biochemical oxygen demand for subcategory 5.D.1 and of chemical oxygen demand for 5.D.2; the methane correction factor value for insufficiently treated wastewater treatment plants (0.05) is much lower than the recommended default value (0.3, range 0.2–0.4), and the EF used for sludge (0.299) has been calculated only based on the measurement made in a single joint implementation project. There is also a lack of clarity in the NIR on how the emission calculations were made. The ERT also noted that there is no clarity either in the NIR or in the information provided by Ukraine during the review on sludge processing practices after sludge is removed and dried for about a year around the wastewater treatment plants area, although emissions from sludge have been considered in the calculations under category 5.D wastewater treatment and discharge, in both 5.D.1 and 5.D.2. The ERT recommends that Ukraine enhance the transparency of its reporting in the NIR of CH_4 emissions from subcategories 5.D.1 domestic wastewater and 5.D.2 industrial wastewater, by providing additional information, explanations and relevant descriptions to ensure a better understanding of the country-specific approach applied for estimating the emissions from wastewater treatment and discharge, including those from removed sludge processing depending on its final destination.	Yes. Transparency
W.14	5.D Wastewater treatment and discharge – N_2O	Ukraine has estimated N_2O emissions from domestic wastewater using a country-specific approach based on the 2006 IPCC Guidelines for indirect N_2O emissions, with country-specific AD and default EFs. The $F_{NON\text{-}CON}$ was calculated according to national statistics on food consumption and MSW, as well as studies on protein content in each food type and on fractions of non-consumed (and landfilled) food. This approach was based on the consideration that the fractions of non-consumed food products are landfilled and not discharged in wastewater. The ERT did not agree with this approach, as the 2006 IPCC Guidelines indicate that the coefficient $F_{NON\text{-}CON}$ reflects the fraction of protein in food that was not consumed and thus discharged in human sewage/domestic wastewater. During the review, Ukraine provided the ERT with calculations using the methodological approach available in the 2006 IPCC Guidelines for estimating the N_2O emissions from domestic wastewater. In consultation with the ERT,	Yes. Accuracy

ID	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? If yes, classify by type
		the 1.1 value of $F_{SOS\text{-}COS}$ recommended for developing countries was selected for the calculations based on the actual living standards in Ukraine and its low per capita value of gross domestic product. The obtained results were lower than those presented in CRF table 5.D. The ERT noted that Ukraine has also reported N_2O emissions from industrial wastewater under subcategory 5.D.2 industrial wastewater based on AD available in the national statistics and following a country-specific methodological approach that considered N from food-related processing industries. During the review, Ukraine explained that in order to avoid double counting, the value 1 for $F_{IND\text{-}COM}$ was used in the estimation of N_2O emissions from subcategory 5.D.1 domestic wastewater. The ERT agreed with this reason of using $F_{IND\text{-}COM} = 1$ in the calculations of the N_2O emissions for subcategory 5.D.1 domestic wastewater. The ERT also noted that Ukraine did not consider in its inventory the direct N_2O emissions from advanced centralized wastewater plants. However, during the review, Ukraine provided the ERT with the calculations of these emissions following the methodological approach available in the 2006 IPCC Guidelines and the AD reported in table 7.14 of the NIR. The ERT agreed with the approach used and the obtained results. The ERT recommends that Ukraine provide in the NIR all relevant information on the methodological approaches, EFs and AD used for reporting N_2O emissions from domestic and industrial wastewater (subcategories 5.D.1 and 5.D.2), including reflecting the selected value (1.1) of $F_{SOS\text{-}COS}$ and direct N_2O emissions from centralized wastewater treatment plants in estimation of (indirect) N_2O emissions from domestic wastewater, as recommended in the 2006 IPCC Guidelines.	
KP-LULUCF			
KL.13	General (KP-LULUCF) – CO_2	The ERT noted that biomass increment, litter net change rate and deadwood net change rate, applied to estimate CSC in lands under AR, deforestation and FM activities, are taken from a single report (Buksha et al. (2007)). However, this report does not contain information on the raw data used, the methodology applied to infer the above indicated CSC factors from the raw data, the accuracy of the CSC factors derived or their associated uncertainty. Furthermore, the report does not provide references for the biomass factors, while those factors provided for DOM do not seem fully relevant, as there is no specific information on DOM data collection and analysis at the country level. Moreover, these factors were not available among archived information of the GHG inventory. The ERT could not, therefore, judge the accuracy of the CSC factors and considers them as expert judgment. During the review, the ERT was informed by the representative of the State Forest Resources Agency of Ukraine that databases containing information on biomass increments as well as on biomass and DOM stocks of the forests managed by the agency are available in its offices, although resources are needed for their elaboration and publication (see IP# G.8 above). The ERT noted that the State Forest Resources Agency of Ukraine directly manages 73 per cent of Ukrainian forests. The ERT therefore recommends that Ukraine implement a complete analysis of relevant information collected by and stored in the databases of the State Forest Resources Agency, which would be used to	Yes. Accuracy

ID[a]	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and or a problem[20] If yes, classify by type
		derive nationwide CSC factors for biomass increments and for DOM net changes, stratified by forest type, ecological region and age class. Further, having considered the technical needs expressed by the State Forest Resources Agency during the review, the ERT encourages Ukraine to plan and implement a national forest inventory system. While new CSC factors are being calculated from the State Forest Resources Agency databases, the ERT recommends that Ukraine use data contained in table 3.9 (p.126) of Buksha et al. (2007) for biomass increments, as stratified by age class and main forest species, together with an age-class distribution for the time series 2013–2016 by revising the DOM CSC factors and method to ensure time-series consistency.	
KL.14	General (KP-LULUCF) – CO_2 and N_2O	The ERT noted that Ukraine used the State Forest Resources Agency information to quantify areas under deforestation. However, such information covers only the forest areas under State Forest Resources Agency administration (i.e. 73 per cent of total national forest area) and does not identify the new land use to which forest is converted. Furthermore, to quantify afforested areas, Ukraine used the information communicated by the State Forest Resources Agency, the Ministry of Infrastructure, the Ministry of Defense and the State Agency of Ukraine on Exclusion Zone Management. The ERT also noted that FM areas correspond to areas that have a legal status of forest in the Ukrainian cadastre, although such legal status may not correspond to the actual land cover; for instance, it is estimated that around 800 kha of area with a legal status of forest have no forest cover, which means that some of the afforestation may have occurred in land already classified as forest and therefore reported under FM. Also, for afforested land, its previous use is unknown. Because of the need to have information on the land use before its conversion to forest for afforested land and after the conversion from forest for deforested land, and because of the need to know with certainty the actual forest area covered by trees, including that temporarily unstocked, the ERT recommends that Ukraine add to its national forest inventory system the data collected through statistically sound surveys of a time series 1990–2016 of land-cover and land-use data for the entire territory. The ERT noted that the land survey may be implemented using freely available data sets of satellite images within a time frame of a few months and with a budget limited to the time of the operators that need to collect data by visual interpretation of satellite images and to analyse data collected to derive a complete time series of consistent land representation of the entire Ukrainian national territory.	Yes. Accuracy
KL.15	General (KP-LULUCF) – CO_2, CH_4 and N_2O	The ERT noted that Ukraine plans to address current shortcomings of spatial data for land representation in its national system for reporting KP-LULUCF activities using CORINE land cover methods and data sets. However, the ERT also noted that Ukraine has not been covered by the CORINE land cover maps and it is not to be covered in the new 2018 map, because it is not yet a member or a collaborating country of the European Environmental Agency. The ERT considered that, even if the pilot project referred to in the plan would successfully test the use of the CORINE land cover methodology for	Yes. Accuracy

ID	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and or a problem[a] If yes, classify by type
		Ukraine, the production of a time series of CORINE land cover maps will go far beyond the deadline of the workplan submitted to address the shortage of spatial information in the national system. The ERT recommends that Ukraine explore alternative data sets of spatial information (e.g. Landsat free imageries) and consider applying survey methods instead of wall-to-wall mapping, because they require fewer resources in an order of magnitude than wall-to-wall mapping and are proven to be easier to implement and provide more accurate data for a given level of resources allocated. The ERT further recommends that Ukraine report in the NIR on data sets and methods the country is planning to use to ensure that a complete time series of land representation will be available for the 2019 annual submission.	
KL.16	Forest management – CO_2	The ERT noted that Ukraine has included in the calculation of the contribution of HWP, in the FMRL and in the GHG estimates the HWP produced during the first commitment period and that has already been accounted for during the first commitment period as instantaneously oxidized. The ERT also noted that although this is a departure from reporting requirements (decision 2/CMP.7, annex, para. 16), it results in conservative accounting of the contribution of HWP. Therefore, the ERT recommends that Ukraine remove HWP produced during the first commitment period from the calculation of the contribution of HWP.	Yes. Accuracy

[a] Recommendations made by the ERT during the review are related to issues as defined in paragraph 81 of the UNFCCC review guidelines, or problems as defined in paragraph 69 of the Article 8 review guidelines. Encouragements are made to the Party to address all findings not related to such issues or problems.

VI. Accounting quantities for activities under Article 3, paragraph 3, and, if any, activities under Article 3, paragraph 4, of the Kyoto Protocol

10. Ukraine has elected commitment period accounting and therefore the issuance and cancellation of units for KP-LULUCF activities is not applicable for the 2017 review.

VII. Question of implementation

11. No questions of implementation were identified by the ERT during the review.

Annex I

Overview of greenhouse gas emissions and removals for Ukraine for submission year 2017 and data and information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, as submitted by Ukraine

1. Tables 6–9 provide an overview of total GHG emissions and removals as submitted by Ukraine.

Table 6
Total greenhouse gas emissions for Ukraine, base year[a]–2015
(kt CO_2 eq)

	Total GHG emissions excluding indirect CO_2 emissions		*Total GHG emissions including indirect CO_2 emissions*[b]		*Land use change (Article 3.7 bis as contained in the Doha Amendment)*[c]	*KP-LULUCF activities (Article 3.3 of the Kyoto Protocol)*[d]	*KP-LULUCF activities (Article 3.4 of the Kyoto Protocol)*	
	Total including LULUCF	*Total excluding LULUCF*	*Total including LULUCF*	*Total excluding LULUCF*			*CM, GM, RV, WDR*	*FM*
FMRL								–48 700.00
Base year	910 617.10	962 501.52	NA	NA	NA		NA	
1990	910 617.10	962 501.52	NA	NA				
1995	525 395.26	572 088.66	NA	NA				
2000	389 101.76	427 645.78	NA	NA				
2010	383 099.07	413 532.30	NA	NA				
2011	414 205.74	434 304.95	NA	NA				
2012	398 753.39	424 214.55	NA	NA				
2013	401 340.84	415 093.70	NA	NA		–912.20	NA	–69 087.86
2014	355 426.37	368 505.88	NA	NA		–959.39	NA	–69 614.42
2015	308 640.74	323 364.93	NA	NA		–1 067.24	NA	–68 962.59

Note: Emissions/removals reported in the sector other (sector 6) are not included in total GHG emissions.

[a] Base year refers to the base year under the Kyoto Protocol, which is 1990 for all gases. Ukraine has not elected any activities under Article 3, paragraph 4, of the Kyoto Protocol. For activities under Article 3, paragraph 3, of the Kyoto Protocol and FM under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

[b] The Party has not reported indirect CO_2 emissions in CRF table 6.

[c] The value reported in this column refers to 1990.

[d] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely AR and deforestation.

Table 7
Greenhouse gas emissions by gas for Ukraine, excluding land use, land-use change and forestry, 1990–2015
(kt CO_2 eq)

	CO_2[a]	*CH_4*	*N_2O*	*HFCs*	*PFCs*	*Unspecified mix of HFCs and PFCs*	*SF_6*	*NF_3*
1990	706 201.58	190 680.74	65 383.36	NO	235.82	NO	0.01	NO
1995	390 073.03	141 350.18	40 487.32	NO	178.06	NO	0.07	NO
2000	279 513.69	119 169.24	28 826.49	20.20	115.74	NO	0.42	NO
2010	293 479.09	87 580.36	31 687.18	749.28	26.67	NO	9.71	NO
2011	306 966.15	88 945.98	37 559.10	825.30	NO	NO	8.41	NO
2012	303 630.25	83 570.79	36 154.44	848.08	NO	NO	10.99	NO
2013	295 880.31	78 087.68	40 221.95	891.22	NO	NO	12.54	NO
2014	256 178.32	71 891.05	39 560.93	859.09	NO	NO	16.49	NO
2015	223 080.53	62 653.33	36 841.09	771.04	NO	NO	18.94	NO
Per cent change 1990–2015	**–68.4**	**–67.1**	**–43.7**	**NA**	**NA**	**NA**	**248 059.6**	**NA**

Note: Emissions/removals reported in the sector other (sector 6) are not included in total GHG emissions.
[a] Ukraine did not report indirect CO_2 emissions in CRF table 6.

Table 8
Greenhouse gas emissions by sector for Ukraine, 1990–2015
(kt CO_2 eq)

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
1990	725 269.22	117 943.75	107 503.76	–51 884.42	11 784.79	NO
1995	431 350.30	57 976.82	71 321.64	–46 693.40	11 439.91	NO
2000	305 436.26	67 144.65	43 770.84	–38 544.02	11 294.02	NO
2010	285 733.07	74 489.80	40 980.91	–30 433.23	12 328.52	NO
2011	295 443.05	80 820.07	45 645.12	–20 099.21	12 396.72	NO
2012	289 924.78	77 283.68	44 691.89	–25 461.16	12 314.20	NO
2013	280 416.59	72 644.18	49 607.22	–13 752.86	12 425.71	NO
2014	245 585.10	61 499.66	49 111.28	–13 079.50	12 309.84	NO
2015	208 930.43	55 961.57	46 326.99	–14 724.19	12 145.93	NO
Per cent change 1990–2015	**–71.2**	**–52.6**	**–56.9**	**–71.6**	**3.1**	**NA**

Notes: (1) Emissions/removals reported in the sector other (sector 6) are not included in total GHG emissions. (2) Ukraine did not report indirect CO_2 emissions in CRF table 6.

Table 9
Greenhouse gas emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol by activity, base year[a]–2015, for Ukraine
(kt CO_2 eq)

	Article 3.7 bis as contained in the Doha Amendment[b]	*Article 3.3 of the Kyoto Protocol*		*FM and elected Article 3.4 activities of the Kyoto Protocol*				
	Land-use change	*AR*	*Deforestation*	*FM*	*CM*	*GM*	*RV*	*WDR*
FMRL				–48 700.00				
Technical correction				–13 435.00				
Base year	NA				NA	NA	NA	NA
2013		–924.22	12.02	–69 087.86	NA	NA	NA	NA
2014		–967.93	8.54	–69 614.42	NA	NA	NA	NA
2015		–1 075.65	8.41	–68 962.59	NA	NA	NA	NA
Per cent change Base year–2015					**NA**	**NA**	**NA**	**NA**

Note: Values in this table include emissions on lands subject to natural disturbances, if applicable.

[a] Ukraine has not elected any activities under Article 3, paragraph 4, of the Kyoto Protocol. For activities under Article 3, paragraph 3, of the Kyoto Protocol and FM under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

[b] The value reported in this column refers to 1990.

2. Table 10 provides an overview of relevant key data for Ukraine's reporting under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

Table 10
Key relevant data for Ukraine under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

Key parameters	*Values*
Periodicity of accounting	(a) AR: commitment period accounting
	(b) Deforestation: commitment period accounting
	(c) FM: commitment period accounting
	(d) CM: not elected
	(e) GM: not elected
	(f) RV: not elected
	(g) WDR: not elected
Election of activities under Article 3, paragraph 4	None
Election of application of provisions for natural disturbances	No
3.5% of total base-year GHG emissions, excluding LULUCF	32 828.397 kt CO_2 eq (262 627.177 kt CO_2 eq for the duration of the commitment period)
Cancellation of AAUs, ERUs, CERs and/or issuance of RMUs in the national registry for:	
1. AR in 2015	NA
2. Deforestation in 2015	NA
3. FM in 2015	NA
4. CM in 2015	NA
5. GM in 2015	NA
6. RV in 2015	NA
7. WDR in 2015	NA

Annex II

Information to be included in the compilation and accounting database

Tables 11–13 include the information to be included in the compilation and accounting database for Ukraine. Data shown are from the original annual submission of the Party, including the latest revised estimates submitted, adjustments (if applicable), as well as the final data to be included in the compilation and accounting database.

Table 11
Information to be included in the compilation and accounting database for 2015, including on the commitment period reserve, for Ukraine
($t CO_2$ eq)

	Original submission	*Revised estimates*	*Adjustment*	*Final*
CPR	2 583 419 064	2 586 919 456		2 586 919 456
Annex A emissions for 2015				
CO_2	223 080 532			223 080 532
CH_4	62 487 281	62 653 334		62 653 334
N_2O	36 569 593	36 841 090		36 841 090
HFCs	771 037			771 037
PFCs	NO			NO
Unspecified mix of HFCs and PFCs	NO			NO
SF_6	18 939			18 939
NF_3	NO			NO
Total Annex A sources	**322 927 383**	**323 364 932**		**323 364 932**
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2015				
3.3 AR	–1 075 653			–1 075 653
3.3 Deforestation	8 414			8 414
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2015				
3.4 FM	–68 962 590			–68 962 590

Table 12
Information to be included in the compilation and accounting database for 2014 for Ukraine
($t CO_2$ eq)

	Original submission	*Revised estimates*	*Adjustment*	*Final*
Annex A emissions for 2014				
CO_2	256 178 321			256 178 321
CH_4	71 891 448	71 891 051		71 891 051
N_2O	39 371 316	39 560 927		39 560 927
HFCs	859 094			859 094
PFCs	NO			NO
Unspecified mix of HFCs and PFCs	NO			NO
SF_6	16 485			16 485
NF_3	NO			NO
Total Annex A sources	**368 316 665**	**368 505 878**		**368 505 878**
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2014				
3.3 AR	–967 925			–967 925
3.3 Deforestation	8 540			8 540
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2014				
3.4 FM	–69 614 418			–69 614 418

Table 13
Information to be included in the compilation and accounting database for 2013 for Ukraine
($t CO_2$ eq)

	Original submission	*Revised estimates*	*Adjustment*	*Final*
Annex A emissions for 2013				
CO_2	295 880 308			295 880 308
CH_4	78 087 677			78 087 677
N_2O	40 021 240	40 221 954		40 221 954
HFCs	891 218			891 218
PFCs	NO			NO
Unspecified mix of HFCs and PFCs	NO			NO
SF_6	12 543			12 543
NF_3	NO			NO
Total Annex A sources	**414 892 986**	**415 093 700**		**415 093 700**
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2013				
3.3 AR	–924 218			–924 218
3.3 Deforestation	12 021			12 021
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2013				
3.4 FM	–69 087 858			–69 087 858

Annex III

Additional information to support findings in table 2

Missing categories that may affect completeness

The categories for which methods are included in the 2006 IPCC Guidelines that were reported as "NE" or for which the ERT otherwise determined that there may be an issue with the completeness of reporting in the Party's inventory are the following:

(a) HFC-134a emissions from mobile air conditioning in 1998 and 1999 (see ID# L.16 in table 5);

(b) CO_2, CH_4 and N_2O emissions and removals from organic soils in land converted to wetlands (see ID# L.35 in table 5);

(c) Indirect N_2O emissions from managed soils (see ID# L.36 in table 5).

Annex IV

Documents and information used during the review

A. Reference documents

Reports of the Intergovernmental Panel on Climate Change

IPCC. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. S Eggleston, L Buendia, K Miwa, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at http://www.ipcc-nggip.iges.or.jp/public/2006gl.

IPCC. 2014. *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at http://www.ipcc-nggip.iges.or.jp/public/kpsg.

IPCC. 2014. *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Geneva: IPCC. Available at http://www.ipcc-nggip.iges.or.jp/public/wetlands/index.html.

Annual review reports

Reports on the individual review of the 2013, 2014, 2015 and 2016 annual submissions of Ukraine, respectively, contained in documents FCCC/ARR/2013/UKR, FCCC/ARR/2014/UKR, FCCC/ARR/2015/UKR and FCCC/ARR/2016/UKR.

Other

Aggregate information on greenhouse gas emissions by sources and removals by sinks for Parties included in Annex I to the Convention. Note by the secretariat. Available at http://unfccc.int/resource/webdocs/agi/2017.pdf.

Annual status report for Ukraine for 2017. Available at http://unfccc.int/resource/docs/2017/asr/ukr.pdf.

Buksha IF, Butrim OV, Bondarchuk GV, et al. 2007. *Development of Techniques for Estimating GHG Emissions and Removals in the LULUCF Sector – Research Report*. Kharkiv, Ukraine: Lis-inform. (Букша ІФ, Бутрим ОВ, Бондарук ГВ, et al. 2007. *«Розроблення методик постинання парникових газів»* / Звіт про науково-дослідну роботу / ТОВ «Ліс-Інформ», Харків. – 2007 р.)

CETI NASU. 2017. *Calculations of Greenhouse Gas Emissions from Coal Combustion in Thermal Power Plants of Ukraine for 1990–2015*. Kiev, Ukraine: Coal Energy Technology Institute of the National Academy of Sciences of Ukraine.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Mykhailo Chyzhenko (Ministry of Ecology and Natural Resources), including additional material on the methodology and assumptions used. The following documents[1] were also provided by Ukraine:

Ministry of Regional development, construction, housing and communal services of Ukraine, 2013. *Form #1-TPV, - National statistical reporting form (blank form) for solid waste (in Ukrainian). Operating since 2007.*

National Statistical Service, 2014. *Form #1 – Waste 'waste management' - National statistical reporting form (blank form) for solid waste (in Ukrainian).*

[1] Reproduced as received from the Party.

National Statistical Service, 2015. *Energy balance of Ukraine*. Excel file.

Shmarin, S., 2017. *Information on flared and recovered methane from MSW. Excel file, accompanied with official (confidential) documentation confirming the amounts of flared and recovered methane.*

Shmarin, S., 2017. *Information of open burning of waste in Vinitsa and Chernigivska regions and calculation of maximal possible emissions (CO_2, CH_4 and N_2O, in CO_2 eq) for confirmation of insignificance of the emissions. Official papers from Vinitsa and Chernigivska regions on open burning of waste accompanied.*

Національна академія наук України Інститут технічної теплофізики (ІТТФ), 2012. *Звіт про науково-дослідну роботу дослідження викидів метану та закису азоту від поводження із стічними водами та розробка методики визначення національних коефіцієнтів викидів (заключний). (National Academy of Science of Ukraine, Institute of Technical thermophisics. Endorsement of a scientific research on methane and nitrous oxide emissions from wastewater and elaboration of a methodology for establishing national coefficients of the emissions).*

Шмарин С. Л., 2015. *Исследование содержания биоразлагаемого углерода в пищевых отходах Украины в городе Борисполь.* Міністерство екології та природних ресурсів україни, Державна екологічна академія післядипломної освіти та управління, Екологічні Науки, Науково-Практичний Журнал 3-4 / 2015 (10-11). Kiev, 2015. (Shmarin, S.L., 2015. *Study on content of biodegradable carbon in food waste in Borispol city.* Ministry of Ecology and Natural Resources of Ukraine, Ecological Academy of Post-Graduate Education and Administration, Ecological Science, Scientific-Research Journal 3-4/2015 (10-11).)

Гожєнко А.І., 2013. *Розробка методики розрахунку та визначення викидів парникових в окремих категоріях хімічної промисловості із побудовою визначеного часового ряду.*

Канюка, 2012. *Розробка методики та визначення викидів гідрофторвуглеців, перфторвуглеців та гексафториду сірки. Частина 1. Секторальні аналізи. Оцінка викидів гідрофторвуглеців (ГФВ), перфторвуглеців(ПФВ) та гексафториду сірки (ГФС) від основних джерел викиду.*

Канюка, 2017. *Міністерство Економічного Розвитку І Торгівлі України Державне Підприємство «Черкаський Державний Науково-Дослідний Інститут Техніко-Економічної Інформації В Хімічній Промисловості» Дп «Черкаський Ндітехім» – reference for 2.F.1.B Domestic refrigeration.*

Канюка, 2017. *Міністерство Економічного Розвитку І Торгівлі України Державне Підприємство «Черкаський Державний Науково-Дослідний Інститут Техніко-Економічної Інформації. В Хімічній Промисловості» Дп «Черкаський Ндітехім» – reference for 2.F.1.E Mobile air conditioning.*